<u>ADVANCED PRODUCTION & QUALITY MANAGEMENT</u>

<u>LESSON PLAN</u>

<u>Course Number:</u> PQM 301

<u>Module & Title:</u> Lesson No. 1, New Paradigms

<u>Length (total):</u> 2 Hours

<u>Terminal Learning Objective:</u>

Given the lecture, discussions, and exercise the student will be able to define the impact of a changing acquisition reform, quality, and systems engineering paradigms on the DoD acquisition community. This lesson provides students with the opportunity to discuss new paradigms that should be affecting the way they do business. The new paradigms targeted in this lesson include acquisition reform, new quality definitions, and IPPD paradigms. Students will discuss the impact of these changing paradigms as they relate to the acquisition community.

<u>Enabling Learning Objectives:</u>

1. Relate the "new way of doing business" as set forth by USD (A&T) and USD (Acquisition Reform).

2. Compare the old and the new quality paradigms. The students will identify the new emerging paradigm for quality. They will then compare and contrast that paradigm with the old one. Basically we are going from inspecting quality to designing and building it in. Students will use this time to develop their own definitions for quality.

2. Identify the impacts of the new IPPD paradigm on Mfg/QA. The students will identify the new paradigm for systems engineering (IPPD). Discuss and contrast sequential engineering with IPPD concepts.

<u>Learning Method:</u> Lecture/Discussion/Exercise

<u>Student Readings:</u> Chase & Aquilano, Chapter 5, pages 186-196
DoD Deskbook, "Quality," Section 2.6.E
SecDef Memo, 6 Dec 95, "Common Systems/ISO-9000/Expedited Block Changes"
USD(A&T) Memo, 8 Dec 95, "Single Process Initiative"
DCMC/CC Memo, 11 Dec 95, "Adoption of Common Processes at Defense Contractor Facilities"

Background References: Quest for Quality, Roger Hale, The Tennant Company, Minneapolis, MN

Conduct of the Lesson:

This lesson is conducted primarily by discussion and some lecture as appropriate. The TLO is accomplished in two major parts - The Development of the New Quality Paradigm, The Development of the New Engineering Paradigm.

The section on Developing New Quality Paradigms takes students through discussions of numerous definitions of quality. Some of these definitions reflect the old paradigm (acceptable quality levels) and some of the definitions will reflect the new paradigm (perfect 1st time quality). Students will develop their own definition of quality that will be used in the RFP exercise to drive contractor behavior to reduce cost while improving quality.

The second section takes students through an analysis of the changing paradigm within the engineering community. Classic engineering models have the engineers working in near vacuums to develop products that meet performance and test requirements. Once they meet those requirements the design is thrown over the wall to manufacturing that has to build to print. The problem is that the design is not producible. The new paradigm has design engineering working very closely with all the other functional areas, especially the technical areas. The goal is to create a design that meets performance requirements while optimizing the ease and economy of fabrication, assembly, test, maintenance, reliability, supportability, environmental, safety and health (ESH), affordability, et. al.

Quality

Description

Quality products and services are fundamental to successful military operations, as well as to successful system development and production. The quality of products, or services is determined by the extent they meet (or exceed) requirements and satisfy the customer(s) at an affordable cost. <u>The goal of an effective acquisition program is to acquire goods and services that meet or exceed DoD requirements, better, faster, and at less cost</u>. The emphasis and practices to achieve quality have evolved dramatically in recent years. The major shift in defense acquisition is to emphasize development of quality products through design of the product and its associated processes. The key to success here is to prevent quality problems through sound processes, not to find them later and do rework.

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Mandatory References

Federal Acquisition Regulation
FAR Part 46, "Quality Assurance"

Defense Federal Acquisition Regulation Supplement
DFARS Part 246, "Quality Assurance"

Defense Logistics Acquisition Regulation
DLAR 46 Quality Assurance

DoD Directive 5000.1, Defense Acquisition, March 15, 1996
Para.D.2., "Acquiring Quality Products"

DoD 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information System Acquisition Programs, March 15,1996
Part 4.3.2, "Quality"

AF Policy Directive 63-5; Quality Assurance; 7 September 1993

AF Instruction 63-501; Air Force Acquisition Quality Program; 31 May 1994

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Discretionary References

Army - AMC Pamphlet 70-27, Guidance for Integrated Product and Process Management
Vol II, Applications
Section III. Integrated Product Team Life Cycle Responsibilities
D. Engineering and Manufacturing Development, Phase II
Worksheet IV, Phase II
"Quality Assurance"
Vol III, Tools and Practices
Section II IPPD Tools and Technologies,
A.2. Modeling Tools and Techologies
"Quality and costumer satisfaction..."

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Quality Management Systems

GENERAL GUIDANCE

Traditional quality management systems have typically focused on the identification and control of hardware that fails to meet specified requirements. Although preventing nonconforming material from reaching the hands of the customer is a critically important function, the traditional quality assurance approach suffers from a number of drawbacks. Foremost among these is that identification and control of defects have proven to be much more costly than preventing their occurrence in the first place. Secondly, inspection and test—even when performed on a 100% basis—often fail to identify all existing nonconformances. Lastly, the use of end item inspection as a principal means of determining product acceptability has frequently led to the perception that workers who perform such inspections and tests—rather than those who design, fabricate, assemble and maintain the product—are responsible for product quality. This shift of responsibility away from those who design, fabricate, assemble and maintain the product, deters effective focus on the product and process design elements instrumental in achieving quality. Unlike the traditional quality approach to obtaining quality products which focused on conformance, product quality is an attribute that is controlled by the engineering/design and business processes, as well as maturation of the associated manufacturing/production process.

This changed view of quality resulted in the following major policy changes which have dramatically changed the DoD perspective on quality:

—SECDEF Memorandum of June 29, 1994, Specifications and Standards - A New Way of Doing Business, encourages use of commercial practices and requires contractors be given flexibility to identify their own quality system requirements. Achievement of quality requires an effective quality management process be employed in conjunction with effective business and technical practices. Achievement of quality requires engineering and manufacturing practices that emphasize robust design, along with enterprise-wide continuous process improvement efforts. Benefits include first time or first pass quality, decreased cycle time, as well as reductions in rework, engineering changes, and inspections. Defense contractors should be required to have a quality system which adheres, at a minimum, to the twenty elements described in ANSI/ASQC-9000. Such a system relies on assessment of the contractor's quality management process, process controls, inspection, and test.

—SECDEF Memorandum, dated May 10, 1995, entitled Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition, provides the framework for achieving quality products through integrated product and process development. Quality products are best achieved through integrated development of the product and its associated manufacturing and support processes, which is an integral part of systems engineering.. Quality must be an integral part of the work of integrated product teams and implementation of IPPD.

—SECDEF Memorandum, dated December 6, 1995, subject Common Systems/ISO-9000/Expedited Block Changes, and USD(A&T) memorandum, dated December 8, 1995, subject Single Process Initiative, provide policy on the use of single processes in a contractor's facility. These memos were intended, in part, to expedite the shift from military quality standards to commercial (ISO/ANSI/ASQC) standards. The goal is to preclude requiring, in a single facility, multiple quality, business or technical processes designed to accomplish the same purposes. The implementation of the single process initiative has coincided with the formulation of local management councils (consisting of representatives of the buying activities, ACO, DCAA and contractor) at affected contractor facilities to assess process issues. Contractor proposed implementation will be reviewed based on submission of concept papers. The program manager should support contractor efforts to implement a single quality management system throughout their facilities. This policy represents a major DoD initiative allowing industry to be more efficient, improve quality and reduce the overall cost of acquiring products.

USD (A&T) Memorandum of February 14,1994 entitled: Use of Commercial Quality System Standards in the Department of Defense requires contractors be given flexibility to identify their own quality system requirements and encourages use of a single quality process in a contractor's facility. The referenced MIL-HDBK-9000, however, is no longer valid due to the new policy of SECDEF memorandum of June 29, 1994, Specifications & Standards - A New Way of Doing Business, which encourages use of commercial practices and requires contractors be given the flexibility to identify their own management systems.

Achievement of quality requires an effective quality management process in conjunction with effective business and technical practices. Achievement requires engineering and manufacturing practices that emphasize robust design along with enterprise-wide process maturity through continuous process improvement efforts. Benefits include first time pass quality, decreased cycle time, as well as reductions in rework, engineering changes, and inspections. These benefits translate into improved affordability and reduced production transition risk. A basic quality management system should be a requirement of the contract, and should adhere, at a minimum, to the twenty elements described in

ANSI/ASQC-Q9000. A basic quality management system relies on assessment of the contractor's quality management process, process controls, inspection, and test and is primarily focused on controlling and detecting manufacturing defects.

Unlike the traditional quality approach to obtaining quality product which focused on conformance, product quality is now viewed as an attribute that is controlled by the engineering/design and business processes, as well as the maturation of the associated manufacturing/production process.

Achievement of quality must be the underlying objective in all program matters including source selection, contract administration and supplier management, risk management, engineering, manufacturing and testing processes, etc.. Quality is the product of effective implementation of these processes. While final inspection and acceptance, and the need to determine the conformance of the product through end item inspection will continue as long as tax payers dollars are being spent, the focus on how to achieve quality has expanded to one of ensuring the appropriate use of best engineering, manufacturing and management practices.

To achieve quality products and services one must focus on the following:

(1) Quality of Design. The effectiveness of the design process in capturing the operational, manufacturing and quality requirements and translating them into robust design requirements that can be manufactured (or coded) and supported in a consistent manner.

(2) Conformance to Requirements. The effectiveness of the design and manufacturing functions in meeting the product requirements and associated tolerances, process control limits, and target yields for a given product group.

(3) Fitness for Use. The effectiveness of the design, manufacturing, and support processes in delivering a system that meets the operational requirements under all required operational conditions.

(4) Cost. The cost of the product and how the design, manufacturing, and management processes affect unit and life cycle costs

The following guidelines for establishing and maintaining an effective quality management program are discussed below:

1. Application and use of commercial quality management standards
2. Encouraging use of a single quality process in a contractor's facility
3. Recognizing and encouraging the appropriate use of practices and tools that lead to acquiring a quality product
4. Establishing and implementing efficient and effective oversight

APPLICATION AND USE OF COMMERCIAL QUALITY STANDARDS

Policy and guidance on the application of quality standards is provided in the FAR Part 46; DFARS Part 246; and SECDEF memorandum of 29 June 94, entitled "Specifications and Standards-A New Way of Doing Business"; and USD(A&T) memorandum of December 8, 1995, titled "Single Process Initiative"

DoD organizations are authorized to use ANSI/ASQC Q-9000, and/or the ISO-9000 series standards in all new contracts, and follow-on work for existing programs, provided contractors are given the flexibility to respond with their own equivalent quality systems. The ANSI/ASQC documents covered under ANSI/ASQC Q-9000 represent different levels of quality requirements outlined as follows:

ANSI/ASQC-Q9001 "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing"

ANSI/ASQC-Q9002 "Quality Systems - Model for Quality Assurance in Production and Installation"

ANSI/ASQC-Q9003 "Quality Systems - Model for Quality Assurance in Final Inspection and Test"

ANSI/ASQC Q-9001, Q-9002 and Q-9003 are the U.S. equivalents and equal to the international quality standards ISO 9001, ISO 9002, and ISO 9003, respectively. The guidance herein applies equally to both the ANSI/ASQC Q-9000 series and the ISO-9000 series documents. Additional guidance on the non-government standards, such as ISO 10005, "Quality management - Guidelines for quality plans," is available through ISO 9000 and 10000 series documents listed the DoD Index of Specifications and Standards.

The elements of ANSI/Q-Q9000 represent a framework for a basic quality system, however, they should not be viewed as the only commercial quality specifications available, nor the most effective basic quality system requirements. Many other industry quality standards (i.e. the auto industries QS-9000) exist and are potentially more effective than the ISO or ANSI 9000 quality standards. It is therefore in the DoD policy to cite the DoD requirement with the words "or equivalent" to allow offerors the flexibility to propose their own equivalent quality system. Quality systems that satisfy DoD acquisition needs should be recognized whether they are modeled on military, commercial, national, or international standards.

The ANSI-9000 standards have a number of limitations in that they address the elements of a

contractor's quality system, but do not address the application of such a system to the products or processes as related to a particular contract. This limitation can be overcome by use of the following statement of objective (SOO) language.

In implementing this guidance in competitive requests for proposals (RFPs) buying activities may consider the following suggested language for performance based statement of work (SOW) the statement of objectives (SOO), Section L, and Section M. (While the sample language that follows is structured for a development phase RFP, it is adaptable for production phase RFPs.)

<u>Suggested SOW/SOO language for a quality system requirement</u>. " The contractor shall implement a quality system that satisfies the program objectives and is modeled on ANSI/ASQC Q9001, or an equivalent quality system."

<u>Suggested Section L language</u>. "Offerors shall propose a quality system that satisfies program objectives and is modeled on ANSI/ASQC-9001, or an equivalent quality system." Offerors shall:

a) Describe the proposed quality system, explaining how it will be applied to reduce program risk, and specifically addressing (as a minimum) the quality system's role in design and development (with particular emphasis on addressing key product characteristics), manufacturing planning, and key program events.

b) Provide a relational matrix comparing, in detail, the proposed quality system with each of the elements of ANSI/ASQC-Q9001"

<u>Suggested Section M language</u> "The offeror's quality approach will be evaluated based on its effective:

a) application to all appropriate aspects of the program
b) coordination with other functions
c) integration into overall program planning; and
d) contribution to reduction of program risk."

The offeror's ability to satisfy the quality management system objectives should be assessed in source selection and continuously monitored after contract award. The elements of ANSI/ASQC-9000 formulate the baseline for review and approval of a contractors quality management process. In reviewing contractor quality management systems, particular emphasis should be given to management responsibility, supplier control, corrective and preventive action, and internal audit.

USE OF A SINGLE QUALITY PROCESS IN A CONTRACTOR'S FACILITY

DoD Policy on the use of single processes in a contractor's facility is provided in SECDEF memo, dated Dec. 6, 1995, subject Common Systems/ISO-9000/Expedited Block Changes, and USD(A&T) memo, dated Dec. 8, 1995, subject Single Process Initiative. These memos were intended, in part, to expedite the shift from military quality standards to commercial (ISO/ANSI/ASQC) standards. The goal is to preclude requiring, in a single facility, multiple quality, business or technical processes designed to accomplish the same purposes. The implementation of the single process initiative has coincided with the formulation of local management councils (consisting of representatives of the buying activity, ACO, DCAA and contractor) at affected contractor facilities to assess process issues. Contractor proposed implementation will be initiated based on submission of concept papers. The PM should support contractors' efforts to implement a single quality management system throughout their facilities.

The above policy represents a major DoD initiative allowing industry to be more efficient, improve quality and reduce overall cost of acquiring products.

RECOGNIZING AND ENCOURAGING THE APPROPRIATE USE OF ENGINEERING AND MANUFACTURING PRACTICES

As previously stated, the prevention of defects, rather than the detection of defects, is the goal of the Department. Advanced quality practices is a term identified by some in industry to mean the appropriate, timely application of engineering, manufacturing, and management practices that emphasize the prevention of defects, rather than detection of defects. Advanced quality practices need to be defined within an organizational context, not as a stand alone list. What may be appropriate for a design, or low rate production enterprise, may not be for a commodity manufacturer, and vice versa. Some of the more commonly used practices in industry include:

1. Identification and control of key characteristics
2. Design to manufacturing process capability
3. Design for manufacturing and assembly (DFMA)
4. Robust design
5. Geometric Dimensioning and Tolerancing
6. Process Variability reduction, of stable, capable manufacturing processes as the basis for product acceptance
7. Control of variation in the measurement system
8. Failure reporting analysis and corrective action system
9. Continuous improvement
10. Other tools such as use of modeling and simulation, CAD/CAE/CAM, and use of maturity models, etc.

While the requirement for a basic quality system is incorporated as a requirement into DoD contracts, the contractors ability to effectively implement the appropriate and effective application of the above type of development and manufacturing practices and tools to meet product requirements is fundamental to achieving quality products; i.e. products that meet the user requirements at an affordable cost.

ESTABLISHING AND IMPLEMENTING EFFECTIVE AND EFFICIENT CONTRACTOR SURVEILLANCE

The cognizant CAS activity verifies that contractors have processes and a quality system that meet contract quality requirements and produce quality products. In coordination with effected Program Manager Offices and buying commands, the CAS activity:

- Identifies critical processes
- Develops and maintains a written risk based surveillance plan
- Performs necessary surveillance
- Performs data analyses and adjusts surveillance accordingly

By working in coordination with each other, the Program Manager Offices/buying commands and the CAS activity can minimize the disruptive impact of DoD surveillance efforts on contractor operations, and reduce DoD's costs of surveillance.

The CAS activity derives confidence from credible contractor data when feasible, but performs sufficient product audits to maintain confidence in that contractor data. DCMC performs independent product audits to verify product conformance with contract technical and quality requirements. When contract non-compliances are observed, the CAS activity requests, evaluates, and verifies contractor corrective actions. The CAS activity also encourages contractors to self-audit and pursue process maturity and effectiveness, waste minimization and continuous improvement.Deficiency Reporting. DoD Components should establish a product deficiency reporting and correction system to track and record the status of the products ability to meet user requirements with feedback to the system developer. The contractor should implement a system that identifies the root cause of in-plant and field defects and promotes design/process changes necessary to prevent their recurrence.

The responsibility and leadership for creating an environment for effective quality design and manufacturing belongs to the highest levels of management. Program managers must convey the leadership and commitment by their own actions in communicating goals, making process effectiveness a key program management issue, and the commitment of resources.

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THE SECRETARY OF DEFENSE

WASHINGTON, DC 20301-1000

6 DEC 1995

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE (ACQUISITION AND TECHNOLOGY)
UNDER SECRETARY OF DEFENSE (COMPTROLLER)
ASSISTANT SECRETARY OF DEFENSE (COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE)
GENERAL COUNSEL
INSPECTOR GENERAL
DIRECTOR OF OPERATIONAL TEST AND EVALUATION
DIRECTORS OF DEFENSE AGENCIES

SUBJECT: Common Systems/ISO-9000/Expedited Block Changes

My June 29, 1994 memorandum on Specifications and Standards directed the use of performance specifications to the maximum extent practicable, and the development of a streamlined procurement process to modify existing contracts to encourage contractors to propose non-government specifications and industry-wide practices that meet the intent of military specifications and standards which impose government-unique management and manufacturing requirements. Although much progress is being made in applying these principles on new contracts, this progress has itself shown that government-unique requirements on existing contracts prevent us from realizing the full benefits of these changes by requiring, in a single facility, multiple management and manufacturing systems designed to accomplish the same purpose. Because it is generally not efficient to operate multiple, government-unique management and manufacturing systems within a given facility, there is an urgent need to shift to facility-wide common systems on existing contracts as well.

In order to meet our military, economic and policy objectives in the future, and to expedite the transition to this new way of doing business, the direction given in my June 29, 1994, memorandum is hereby revised. In addition to the direction given there for government-unique specifications and standards, I now direct that block changes to the management and manufacturing requirements of existing contracts be made on a facility-wide basis, to unify management and manufacturing requirements within a facility, wherever such changes are technically acceptable to the government. The single point of contact for this effort will be the Administrative Contracting Officer (ACO) assigned to a facility.

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The Under Secretary of Defense for Acquisition and Technology shall issue additional guidance necessary to facilitate the Department's streamlined review of contractor's proposals to replace government-unique management and manufacturing requirements in existing contracts with uniform requirements within the contractor's facilities.

We cannot afford to allow "business as usual" to delay this initiative. I therefore request that you and your leadership take an active role in expediting the transition of existing contracts and reprocurements to common systems.

William J. Perry

THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3010

ACQUISITION AND TECHNOLOGY

DEC 0 8 1995

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE (COMPTROLLER)
ASSISTANT SECRETARY OF DEFENSE (COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE)
GENERAL COUNSEL
INSPECTOR GENERAL
DIRECTOR OF OPERATIONAL TEST AND EVALUATION
DIRECTORS OF DEFENSE AGENCIES

SUBJECT: Single Process Initiative

Secretary Perry's memorandum of December 6, 1995 requested that I promulgate guidance for making block changes to existing contracts to unify the management and manufacturing requirements of those contracts on a facility-wide basis, wherever such changes are technically acceptable to the government. Secretary Perry further directed that the single point of contact for this effort will be the Administrative Contracting Officer (ACO) assigned to a facility. Accordingly, I am providing the following additional guidance on these issues.

Replacement of multiple government-unique management and manufacturing systems with common, facility-wide systems should, in the long run, reduce the costs to both our contractors and the DoD. Contractors will, however, in most cases incur transition costs that equal or exceed savings in the near term. We expect that cases where this does not hold true are in the minority, mostly dealing with high value, long-term contracts. Accordingly, I direct use of an expedited, streamlined approach to ensure that the contractors' proposals of block changes are technically acceptable and to quickly identify those cases where there may be a significant decrease in the cost of performance of existing contracts.

ACOs are directed to encourage contractors to prepare and submit concept papers (see the attached TAB A) describing practices that will permit uniform, efficient facility-wide management and manufacturing systems and a method for moving to such systems. Contractor recommendations included in the concept paper should be accompanied by a cost-benefit analysis adequate to determine the rough order of magnitude of the costs and benefits to the contractor of the proposed system changes (including any impact on the cost of performance of existing contracts). This cost benefit analysis shall be performed without requesting certified cost or pricing data. The detail included in these concept papers/cost analyses is intended to be just sufficient to allow an informed, rapid judgement by the ACO on whether proposed changes to management and manufacturing processes can be approved on a no-cost, block change basis, applying guidance in this letter.

Where such a proposal is technically acceptable and there are no significant net savings in the cost of performing existing contracts, the ACO, after appropriate consultation with program managers, shall issue class modifications to those contracts without seeking an equitable adjustment. In those cases where the contractor's proposal will result in significant decreases in the overall net cost of performance of existing contracts, the contractor should be asked to submit a formal proposal for an equitable adjustment (consideration) and to submit separate, detailed cost data in support of the proposed amount. The negotiation of equitable adjustments should not delay the modification of contracts.

Note that the specific shift from MIL-Q-9858A to ISO-9000 does not in itself result in significant contractor savings in most contracts, and hence can be made on an expedited basis.

I also direct that, effective immediately, ACOs have the authority to execute class modifications, subject to receipt of necessary programmatic authorization from affected components.

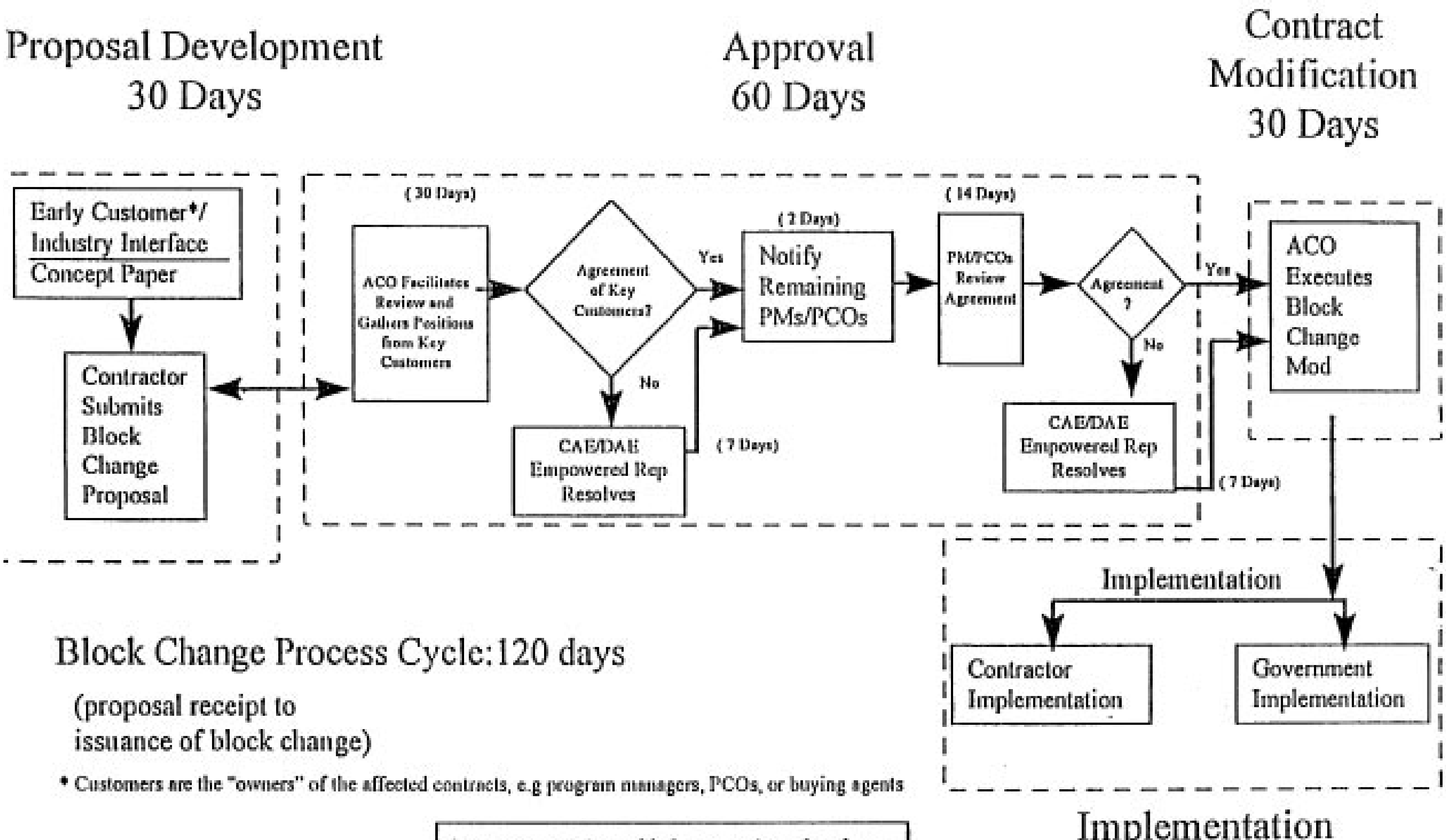
The Commander, Defense Contract Management Command (DCMC) shall approve all requests for certified cost or pricing data in connection with this initiative unless such data are required by law. He will also be the focal point for implementing these efforts within DoD, and will facilitate the coordination of the change process. Tab A depicts the block change process detailing underlying assumptions, roles, and responsibilities.

The Commander, DCMC should prepare for me and for the Component Acquisition Executives a brief quarterly report that describes the progress achieved in replacing multiple government-unique management and manufacturing requirements in existing contracts with more efficient, common facility-wide practices.

Paul G. Kaminski

Paul G. Kaminski

BLOCK CHANGE PROCESS OVERVIEW



Block Change Process Cycle:120 days

(proposal receipt to
issuance of block change)

* Customers are the "owners" of the affected contracts, e.g program managers, PCOs, or buying agents

Process Builds on Existing
Organization Structures

BLOCK CHANGE PROCESS

The block change process depicted here designates DCMC as the lead facilitator to implement plant-wide changes. The process is built on existing structures within the components and OSD and is designed to create a sense of urgency in the approval process for streamlining of specifications, standards or other processes.

PROPOSAL DEVELOPMENT

Industry is encouraged to prepare and submit concept papers for streamlining specifications and standards with emphasis on early customer involvement and interface. Once the cost and benefit of the change has been determined through this early involvement, industry shall submit block change proposals. As a minimum, the proposals should detail the proposed processes and associated metrics, rough order of magnitude cost benefit analysis, the consequent changes in government's involvement in the process and required regulatory/contractual changes.

APPROVAL

Following submittal of the proposal, the Contract Administration Office (CAO) shall determine the contractual/regulatory scope of change, confirm the component customer base impacted and, if required, organize a local management council based on the nature of the proposal. The management council should be comprised of senior level representatives from the local CAO, the cognizant Defense Contract Audit Agency (DCAA) office, the contractor and subject matter experts representing the key customers within the affected components. Notionally, the key customer base shall be comprised of customers who represent 80% of the total dollar value of affected contracts.

ROLES AND RESPONSIBILITIES

The role of the management council is to analyze the merits and cost benefits of the change. Empowerment of subject matter experts from the key customer base is critical. To minimize delay, a component team leader should be designated and granted decision authority by the CAE to represent the key customer base. Component team leaders are responsible for achieving consensus with other component team leaders, the key customer PCOs and PMs, the component team members and the CAE. The CAO should be responsible for facilitating and leading the management council. The ACO will have the contractual authority to execute all block changes. The attached diagram shows the decision process along with timelines expected of this streamlined process.

INTERNAL GOVERNMENT RESOLUTION PROCESS

The objective of this process is to resolve disagreements, facilitate consensus, elevate and resolve issues of substantial concern, and re-emphasize the overall goal and objective. If there is disagreement between PM or other customers within a component, the issue must be raised to a level within the service as designated by the CAE. It there is disagreement among the components the issue must be raised to a level within the Department as designated by the DAE. Once resolved, the ACO executes the change.

NEWS RELEASE
OFFICE OF ASSISTANT SECRETARY OF DEFENSE
(PUBLIC AFFAIRS)
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IMMEDIATE RELEASE December 8, 1995

DEPARTMENT OF DEFENSE ANNOUNCES POLICY ON SINGLE PROCESS INITIATIVE

Secretary of Defense William Perry announced today a new policy designed to implement a single process initiative leading to the use of common processes and performance specifications on existing Department of Defense contracts. Using a "block change" modification approach, it will involve the consolidation or elimination of multiple processes, specifications and standards in all contracts on a facility-wide basis, rather than on a contract-by-contract basis.

"Our principal acquisition reform initiatives in this area thus far were focused on new contracts. This single process initiative is significant in that it impacts existing contracts," Perry said.

Currently in many contractor facilities several different processes or specifications may be used for similar manufacturing or management operations due to differing requirements in various contracts. This approach is inefficient, leading to increased cost and administrative workload for both the contractor and the government. Over the last year, several initiatives moved towards changing this situation. Participating in these efforts were the Non-Government Standards Integrated Process Team (NGS IPT) sponsored by the Joint Logistics Commanders and the Common Process Facility Working Group, co-chaired by OSD's director, Test, Systems Engineering and Evaluation and the commander, Defense Contract Management Command (DCMC). In August of this year, members of these agencies and the OSD staff began working together to draft the policy. Their efforts resulted in the policy being announced today.

The policy on the single process initiative recognizes the following facts:

- Since DoD will not realize the full benefits of it's specifications and standards policy until all contracts in a facility have been converted, the process to make the changes to those contracts must occur as quickly as possible. A streamlined approach is vital, avoiding unnecessary paperwork and costly contractor proposal preparation. However, adequate safeguards must be in place to ensure the receipt of consideration from the contractor, when appropriate.

-MORE-

- Since the focus of the change is plant-wide, rather than being isolated to one program or product, the DCMC in-plant personnel, particularly the administrative contracting officer, will play a key role in facilitating the process.. However, since the changes will impact all the programs and products that facility produces, the "customer" community of program managers and buying commands must be consulted. A management council approach, similar to the current DCMC Reinvention Lab initiative, will be used.

Since the savings related to this effort can not be realized until the contracts are changed, time is of the essence. The Department recognizes that implementing this policy will cause contractors to incur some transition costs that will offset short term savings. Since this period of offset savings may exceed the life of most of the existing contracts, net savings can only be reasonably expected on longer term, fixed price contracts. Therefore, DCMC will conduct an analysis to determine the extent of the change and the remaining life of existing contracts in order to identify those contracts where there will be significant savings and where consideration may be due to the government. All other contracts may be modified based upon the initial analysis without the requirement for contractors to prepare detailed cost proposals, an expensive and time consuming process.

The benefits of this action are many. The acceleration of bringing common processes to contractor facilities will result in more efficient, consistent and stable processes, with greater ease of contract administration for both contractor and government, and savings for the taxpayer.

-END-

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DEC 11 1995

IN REPLY REFER TO AQ

MEMORANDUM FOR COMMANDERS, DEFENSE CONTRACT MANAGEMENT DISTRICTS
COMMANDER, DEFENSE CONTRACT MANAGEMENT COMMAND INTERNATIONAL

SUBJECT: Adoption of Common Processes at Defense Contractor Facilities

The adoption of common processes by contractors in lieu of multiple, unique DoD standards and specifications is one of the cornerstones of acquisition reform. Recently issued letters by Secretary Perry and Under Secretary Kaminski underscore the importance of accelerating this shift toward facility-wide common processes (Attachment 1). DCMC will play a pivotal role in this major initiative by both encouraging contractors to submit common process proposals and expediting their review and approval.

Common processes are intended to help reduce contractor operating costs, and contribute to cost, schedule, and performance benefits for the Government. Unlike traditional contract specific changes, process changes are intended to cross all contracts at a particular facility. For this reason, and although it is clear that both the Government and contractors can mutually benefit from the adoption of common processes, the review and approval of contractor process change proposals require special technical and cost consideration. Attachment 2 provides further guidance in each of these two areas.

Critical to the success of this effort are communication and coordination with customer buying activities and program management offices. Cost-benefit analysis must be fully explored and coordinated in order to build consensus among all parties on the concept. Each field office should establish a Management Council comprised of contractor, DCMC, DCAA, and key customer representatives in order to facilitate a timely and constructive exchange of information. The field office should work closely with the Management Council to ensure that the concept paper contains sufficient technical and cost information to permit adequate evaluation.

To help promote this initiative and also assist ACOs and other DCMC functional specialists in the review of contractor proposals, we are establishing a Block Change Management Team at HQ DCMC. A draft charter for this team is at Attachment 3. Among other tasks assigned to the team are the development of a "Road Show" package for conducting briefings across the Command, and the establishment of field level SWAT teams that will be available to assist ACOs in reviewing common process proposals.

Should there be any questions, the point of contact is Mr. Frank J. Lalumiere. He can be reached at (703) 767-2412 or DSN 427-2412.

ROBERT W. DREWES
Major General, USAF
Commander

Attachments

Common Process Block Changes

A block change is a contract modification that implements a common process across all contracts at a contractor's plant. Listed below are some key steps that should be taken to facilitate the proper review and disposition of common process proposals submitted by contractors.

1. CONTRACTOR/CUSTOMER/CAO INTERFACE: The Contract Administration Office (CAO) acts as the primary industry interface, proactively informing contractors about the common process approach, and advising contractors how to prepare and submit initial concept papers and more detailed proposals, if necessary. The concept paper should include a cost/benefit analysis by the contractor, sufficient to identify the rough order of magnitude of the cost and technical impact of the proposed common process change on government contracts. Contractors should be encouraged to consider any common process approach that realizes a cost schedule or performance benefit for both the contractor and the Government. The CAO will notify the key customers when a contractor volunteers to participate in the process. The CAO shall request from the largest component customer in accordance with the Service issued guidance that an individual be designated as the component team leader. After the program office/buying activity identifies the component team leader, the CAO will notify all Service customers who that individual is.

2. CONCEPT PAPER/PROPOSAL REVIEW & EVALUATION: The CAO must perform a review of the adequacy and reasonableness of the contractor's concept paper and supporting cost/benefit analysis. The concept paper should outline the proposed process and planned transition approach. Technical feasibility, cost effectiveness, and program risk are elements that should be fully explored with the contractor.

The CAO should work closely with customer buying activity and program management office customers and the contractor during review. The intent is to expedite a review and determination by the ACO as to whether the change can be approved on a no cost, block change basis. In those instances where it is determined that significant cost savings will result, the ACO, in coordination with the customers, must determine the format and amount of detail required to be included in a more formal contractor proposal. Business judgement should be used to ascertain the required level of supporting documentation.

The proposal should be reviewed by a local team of CAO technical and cost specialists, the cognizant DCAA auditor and the key customers. The contractor should participate in this review and provide any necessary, additional supporting data concurrent with the review process.

3. TECHNICAL CONSIDERATIONS:

(1) The common process should be sufficiently defined, structured, and documented to permit full evaluation. Customer buying activity programs that are affected in the various Service components or other defense/civilian agencies

must be identified.
(2) Among other questions and issues that should be addressed during review of the contractor's proposal are:

(i) Will implementation of the common process be advantageous to the government? Does the common process encourage the use of advanced practices, eliminate nonvalue added requirements, eliminate redundant audits, reduce oversight cost, etc.?

(ii) How will the contractor demonstrate acceptability and reliability of the common process?

(iii) What is the impact on the government and contractor if the common process is approved/disapproved? Has a risk analysis been performed? (The technical feasibility of the common process must be addressed in relation to the impact on such areas as quality, maintenance, and life cycle cost.)

(iv) How will the contractor implement the common process? Will the change be phased in? How does the contractor propose to maintain quality, schedule, etc. during the transition?

(3) The kind and degree of technical review will vary with the complexity of the processes involved. Some process changes may not have a significant impact on quality, maintenance, performance, or life cycle cost. Other process change proposals will present a myriad of technical issues requiring indepth review by contractor, DCMC, and buying activity personnel. Further, while some proposals may be readily adopted for all contracts on a facility-wide bases, other proposals may be suitable for the majority, but not all government contracts at a particular contractor facility.

For example, the proposed common process might involve the adoption of commercial packaging practices. Prior to approval on a facility-wide basis and modification of all government contracts, a technical review must confirm that there are no special packaging or packing requirements needed to satisfy cold weather storage, salt water exposure, or shelf-life expectancy, etc.

Other common process proposals may require an assessment by contractor, DCMC, and program office personnel of the impact on maintenance, supply availability, and associated costs to the government. Should a common process proposal, for example, introduce multiple variants of a component or system, the government would need some assurance that the contractor could produce sufficient, timely notification of correct configuration information for each variant, down to the piece part level. To the extent that a change introduces more parts, part numbers, or substitutes for original parts, an evaluation of the proposed change must consider whether there is sufficient technical documentation of the parts to permit the government to identify the proper application, and whether the government can properly control and adequately disseminate the information to ensure supportability. Also, the evaluation of some proposals will require an assessment of the need to train government personnel on the changes, and the associated training costs. These kinds of complex, technical issues will surface with greater frequency in situations where end product performance specifications are proposed as substitutes for multiple military specifications. On occasion, however, they may arise during the review of common process proposals submitted by contractors.

4. <u>COST CONSIDERATIONS:</u>

(1) Should the review indicate that the proposed change generates significant savings on an existing contract, consideration should be negotiated for the contract. If the resulting contract modification involves a price adjustment that exceeds the TINA threshold, certified cost and pricing data may be required per FAR 15.8. (The Commander, DCMC shall approve any ACO request for certified cost and pricing data, unless specifically required under TINA.)

(2) If the review reveals that the implementation cost is equal to the savings realized, or the savings are immaterial on existing contracts, a block modification may be used to implement the change at no cost to the Government. Consideration should be determined based on normal business judgment which could include the absolute dollar value, as well as the dollar value of savings as measured against the overall contractor sales base. Under some circumstances, consideration flowing to the Government may be other than monetary consideration. ACOs must apply good business judgement following a full review of each concept paper or proposal and the factors involved.

(3) In order to ensure the government realizes savings on future contracts and contract modifications, contractor proposals should address forward pricing rate reductions. The ACO and auditor should review the adequacy of the proposed rate reductions for use and incorporation in forward pricing rates.

(4) The overall objective should be to reduce the administrative burden as much as possible, yet still satisfy customer requirements. Once the ACO has selected the appropriate course of action (block changes, individual modifications or a combination of the two), the proposed actions should be presented to the Management Council for concurrence.

5. <u>MANAGEMENT COUNCIL OVERSIGHT:</u> The Management Council structure at each CAO will help to facilitate the review and disposition of common process proposals. The Council membership should include DCMC and DCAA representatives, as well as representatives from key customer buying activities. Generally, representation on the Council should account for at least 80 percent of the customer buying activity business base impacted by the process change. Upon reaching agreement at the Management Council level, any other buying activity/program management office customers must be advised of, and concur with, the process change.

DRAFT CHARTER
BLOCK CHANGE MANAGEMENT TEAM

RESPONSIBILITIES

1. Encourage contractors to submit block changes.

The DoD letters direct ACOs to encourage contractors to submit block changes. The team will be responsible for developing methods to facilitate early field office comprehension of the common process/block change policy and procedures because the first message needs to be consistent, consistently stated, and stated as quickly as possible. Specifics follow:

A. Develop a standard letter for ACOs to use in encouraging contractors to submit common process concept papers.

B. Develop a "road show" package for DCMC personnel (briefing charts, script, handouts, etc) that explain the DoD objective in the common/process block change policy, the purpose of block changes, the benefits to contractors, success stories from others who have already done it, the process, etc.

C. Develop mechanisms to enable ACOs to continue to spread the message and encourage submittals after the team's departure.

2. Provide assistance to ACOs in processing/negotiating block changes.

A. Stand up "SWAT teams" that are capable of assisting ACOs in processing/negotiating block changes. SWAT teams should be teams of DCMC technical and business experts who can give advice or go on-site to assist in analysis and negotiations.

B. Facilitate interactions with customers to get approval for common processes and block changes.

C. Develop networks to enable ACOs to find assistance after SWAT teams are disestablished.

3. Refine guidelines for processing/negotiating block changes.

A. Amend/expand guidelines for processing/negotiating block changes as needed to respond to experiences and lessons learned.

B. Develop one book chapter for common process/block changes.

4. Keep DCMC Commander, OSD, and the SAEs informed of progress.

A. Develop and submit required reports to OSD. The DoD letter requires quarterly reporting of progress from the DCMC Commanders. Develop report format, put in place collection procedures for the field, gather data, and submit reports.

B. Submit "weeklies" (weekly status reports) to the SAEs. Reports should concentrate on the places where SAE involvement and encouragement would be worthwhile.

5. Monitor execution in field.

A. Keep in touch with CAOs to cheerlead, remove barriers, etc., but

B. Do not burden the field with extraneous reporting requirements.

6. Go out of business within 9 to 12 months.

A. Develop plan to institutionalize processing/negotiating block changes within dcmc.

B. Get plan approved and execute it.

MILESTONES

Develop standard letter	NLT 5 Jan
Develop road show	NLT 15 Jan
Do road shows	15 Jan - 15 Mar
Stand up SWAT teams	NLT 31 Dec
Develop reporting requirements	NLT 15 Jan
Rest TBD by team	

MEMBERS

Mr. Mike Vezeau (DCMC) -- Lead	TBD (OSD)
Ms. Jane Curtis (DCMC)	TBD (Army)
Mr. Syd Pope (DCMC)	TBD (Navy)
Mr. Dave Robertson (DCMC)	TBD (Air Force)
Ms. Josephine Ross (DCMC)	TBD (DCAA)
Mr. Mike Dudley (DCMC)	TBD (DoD IG)
MAJ Jack Econom (DCMC)	TBD (DLA)
Ms. Pat Matura (DCMC)	

DCMC team members to round up TBD members. Also to augment with DCMC field personnel if necessary.

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH DEVELOPMENT AND ACQUISITION
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

REPLY TO
ATTENTION OF

21 DEC 1995

SARD-PP

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Common Process Facilities Initiative

References:

a. Secretary of Defense memorandum, December 6, 1995, subject: Common Systems/ISO-9000/Expedited Block Changes.

b. Under Secretary of Defense (Acquisition and Technology) memorandum, December 8, 1995, subject: Single Process Initiative.

The referenced memoranda (copies enclosed) move the common process facilities initiative forward another step. In addition to using common processes for all future contracts to be performed in a particular facility, Secretary Perry wants to begin incorporating such processes into current contracts.

This "block change" process is described in the attachment to reference b. As it applies to Army activities, the process is —

— Upon receipt of a contractor's proposal for streamlining specifications and standards and establishing common processes, the Defense Contract Management Command (DCMC) will so notify the contractor's largest Army customer.

— That Army activity, whether Program Executive Officer or buying command, will designate an Army team leader to assist the Deputy Assistant Secretary of the Army (Procurement) (DASA(P)) in representing all Army customers in the evaluation of the contractor's proposal. The designated Army team leader shall also sit, along with the DASA(P), on the management council established to evaluate the proposal.

— The DCMC will notify all Army customers of the identity of the designated Army team leader.

— The Army team leader shall notify the DASA(P) of the designation as team leader.

— The Army team leader shall coordinate proposal evaluation and acceptance efforts with all affected Army customers and the DASA(P), to include authorizing the DCMC to execute block modifications to Army contracts either with or without equitable adjustments.

— In coordination with the DASA(P) the Army team leader has the authority to resolve disagreements between various affected Army customers, and to develop the Army position on disputed issues.

The common process facility initiative has significant potential for future cost savings and, in many cases, for reducing the cost of current contracts as well. The Army is firmly committed to exploiting this potential for cost savings, and I expect that all Army participants in this effort will do their best to make it succeed.

If you have any questions, contact either COL Lee Thompson, DSN 761-7569 or Mr. Curtis Stevenson, DSN 227-2630.

Kenneth J. Oscar

For Gilbert F. Decker
Assistant Secretary of the Army
(Research, Development and Acquisition)

Enclosures

DISTRIBUTION:
Program Executive Officer-Armored Systems Modernization, Attn: SFAE-ASM, Warren, MI 48397-5000

Program Executive Officer-Aviation, Attn: SFAE-AV, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798
Program Executive Officer-Command, Control and Communications Systems, Attn: Attn: SFAE-CC, Fort Monmouth, N.J. 07703-5000
Program Executive Officer-Field Artillery Systems, Attn: SFAE-FAS, Picatinny Arsenal, N.J. 07806-5000
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Program Executive Officer-Standard Army Management Information Systems, Attn: SFAE-PS, 9350 Hall Road, Suite 142, Fort Belvoir, VA 22060-5526
Program Executive Officer-Tactical Wheeled Vehicles, Attn: SFAE-TWV, Warren, MI 48397-5000
Program Executive Officer-Tactical Missiles, Attn: SFAE-MSL, Redstone Arsenal, AL 35898-8000
Commander, U. S. Army Materiel Command, 5001 Eisenhower Avenue, Attn: AMCAQ, Alexandria, VA 22333-0001
Commander, U. S. Army Space and Strategic Defense Command, Attn: CSSD-ZB, P.O. Box 1500, Huntsville, AL 35807-3801
Commander, U. S. Army Missile Command, Attn: AMSMI-CG, Redstone Arsenal, AL 35898-5000
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Director, Information Systems for Command, Control, Communications and Computers, Attn: SAIS-Z, Washington, DC 20310-0107

cf:

SARD-ZT
SARD-ZR
SARD-ZS
SARD-ZD
SARD-ZC
SAGC
Commander, Defense Contract Management Command, Attn: AQOG, 8725 John J. Kingman Road, Suite 3317, Ft. Belvoir, VA 22060-6221

ADVANCED PRODUCTION & QUALITY MANAGEMENT

LESSON PLAN

Course Number: PQM 301

Module & Title: Lesson No. 2, Systems Acquisition Overview

Length (total): 1.5 Hours

Terminal Learning Objective:

Show the current systems acquisition life cycle phases as well as major activities to be accomplished within the acquisition management system framework. *This lesson introduces the requirements generation or pre-milestone 0 activities, the systems acqusition life cycle phases and the current DoD 5000 series directive and regulation guidance. These will be referenced throughout the course to establish the time frame of topics covered.*

Enabling Learning Objectives:

1. Differentiate the requirements generation system and the program, planning, and budgeting system to the acquisition management system. *These three decision-making systems are used in the DoD pre-milestone 0 and program execution acquisition stages. The breadth of each of these systems and their interrelationships are discussed. Application knowledge of these decision-making systems are important to the SPRDE functional area.*

2. Distinguish between the different life cycle activities and their interrelationships. *The life cycle activities (from ACQ 201) will be discussed and the changes brought about by the current 5000 series documents that impact the life cycle for the development, production, and support of a system.*

Learning Method: Expository Discussion

Student Readings: None

Instructor Readings: "Acquisition of Defense Systems," Przemieniecki,
Chap. 2,3,7, Chap 10, pp. 177-203.
Chap. 13, pp. 85,86, and pp. 243-257.

Background References: DoDD 5000.1 (Mar 15, 1996)
DoD 5000.2-Regulation (Mar 15, 96)
Process Action Team on Military Specifications and Standards Report recommendations (Report #AD-A 278 102)
EIA IS-632/IEEE 1220
Federal Acquisition Streamlining Act (FASA)
"Specifications & Standards - New Way of Doing Business" memo of Dr. Perry's dtd 29 Jun 94
MOP-77
Cost as an Independent Variable (CAIV) memo dtd 4 Dec 95

Conduct of the Lesson:

This lesson is conducted by expository discussion where appropriate. The TLO is accomplished in two major parts - Requirements Generation and Acquisition Life Cycle.

The Requirements Generation portion of this lesson will focus on the pre-milestone activities leading up to the Mission Need Statement and will be a review of some of the material presented in the ACQ 201. Emphasis is placed on how this process can lead to the development of materiel solutions to meet user requirements. The interrelationships of the three decision-making support systems - Requirements Generation; Planning, Programming, & Budgeting; and Acquisition Management will be emphasized.

The Acquisition Life Cycle portion of this lesson will present pertinent changes being introduced by the current DoDD 5000.1 and DoD 5000.2-R. The acquisition “chain of command” and acquisition categories will also be discussed.

LESSON ASSIGNMENT SHEET

Advanced Production &
Quality Management Course (APQMC)

<u>Course Number:</u>	**PQM 301**
<u>Module & Title:</u>	**Lesson No. 3, Risk Management**
<u>Length (total):</u>	**2 Hours**

<u>Terminal Learning Objective:</u>

Given an illustrated acquisition program case, evaluate the effectiveness of a risk management process in an Integrated Product and Process Development (IPPD) / Integrated Product Team (IPT) environment.

<u>Enabling Learning Outcomes:</u> The student will be able to:

- Define the background and rational for updated risk management policy in DoD.
- Define the basic categories and examples of risk for acquisition programs.
- Describe recent lessons learned from past risk management programs.
- Describe Measures of Effectiveness for a Risk Management Process.
- Evaluate the application of a hypothetical Risk Management Process and recommend improvements to the process to mitigate a program's risk within an Integrated Product and Process Development (IPPD) / Integrated Project Team (IPT) environment.

Assignments:

Review: Attached Teaching Note, "Program Risk Management", dated 15 December, 1997
Read: Case study for in-class exercise.

ESPT: 90 minutes

PRINCIPLES OF PROGRAM MANAGEMENT DEPARTMENT

Teaching Note

Program Risk Management

W.W. Bahnmaier & Paul McMahon[1]

December 15, 1997

Introduction[2]

Risk management identifies the uncertainties that threaten cost, schedule, and performance objectives, and develops and implements actions to best deal with those uncertainties within established limits. It also highlights opportunities that are present if risk is managed properly. Its primary focus is:

- To identify and manage risk so that program objectives can best be achieved, and

- To support development of an acquisition strategy to meet the user's needs while balancing cost, schedule, performance, and their risks.

With a few praiseworthy exceptions, we in defense acquisition have not been particularly effective in achieving these objectives. Defense acquisition is in an era of acquisition reform where we must do better and can no longer rely on "The Threat" to compensate for unrealistic cost, schedule, and performance objectives that do not adequately recognize program risks. The Concept of "Cost as an Independent Variable" (CAIV) - where DoD no longer pursues performance objectives at "ANY COST" - is a cornerstone of the acquisition approach. Programs that experience significant cost growth or schedule slips are more likely to be canceled than bailed out. Successful programs recognize and mitigate major risks and are managed to deliver and support systems that are on-schedule, within budget, and meet performance requirements.

Terms and Definitions

Risk. In general, risk can be defined as the possibility of loss or injury. It has two components: a likelihood of occurrence (probability) and an undesirable consequence. A risk event is a function of the probability and negative consequence – something that could go wrong. Both risk events and opportunities evolve from uncertain events such as tests, experiments, processes, etc. We must understand these components, so that we may effectively manage risk.

Acquisition Risk. Every program is subject to uncertainties that may result in failure to achieve cost, schedule, or performance goals. Exposure to these adverse possibilities constitutes acquisition risk. The Defense Acquisition Deskbook defines Acquisition Risk as:

"..... a measure of the inability to achieve program objectives within defined cost and schedule constraints. This inability is the result of one or more undesirable events that occur during the program life cycle, for which there are not sufficient resources and time programmed to overcome."

Sources / Areas of Risk. Section 2521 of the Deskbook[3] identifies a number of risk sources or areas (threat, requirements, design, etc.) that through experience, contain those risk events that tend to be more critical than others. These should receive the most management attention. Risk events are derived from both a Work

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[1] Originally published by Colonel Rick Owen, USMC; subsequently updated by current authors.

[2]This teaching note directly follows the procedures and philosophy laid out in the risk material provided in the Defense Acquisition Deskbook, Para 2.5.2.1 – 2.5.2.4, Version 2.1, dtd 30 Sept 97.

[3] File Owner: Mike Zsak, OUSD(A&T)/DTSE&E
Owner Ph #: (703) 681-8426, Email: zsakmg@acq.osd.mil

Breakdown Structure view of the product and from a process view using the templates contained in DoD 4245.7M. These risks are general in the sense that they are the types of risks that could be present in any program from either source (WBS product or process). They are intended as a list of "top-level" risks that will focus users' attention on a specific area. If the risk present in a program were thought of as a taxonomy of risks, those shown here would be the type found at the highest levels of the classification. The PMO and contractor(s) will have to go to lower levels of this taxonomy to understand the actual risks that are present in their program and to develop an effective risk management plan. The risk areas identified below are not intended to serve as a simple checklist that one should apply directly and naively feel comfortable that the program is risk free if none of the listed risks are present.

Significant Risks by Critical Risk Areas (Deskbook Table 2522-2)

Risk Areas/Sources

Threat	-Uncertainty in threat accuracy and stability -Sensitivity of design and technology to threat -Vulnerability of system to threat countermeasures -Vulnerability of program to intelligence penetration
Requirements	-Operational requirements not properly established or vaguely stated for program phase -Requirements are not stable -Required operating environment not described -Requirements do not address logistics and suitability -Requirements identify specific costlier solutions
Design	-Design implications not sufficiently considered in concept exploration -System will not satisfy user requirements -Mismatch of user manpower or skill profiles with system design solution or human-machine interface problems -Design not cost effective -Design relies on immature technologies or "exotic" materials to achieve performance objectives
Test and Evaluation	-Test planning not initiated early in program (Phase 0) -Testing does not address the ultimate operating environment -Test procedures do not address all major performance and suitability specifications -Test facilities not available to accomplish specific tests, especially system-level tests -Insufficient time to test thoroughly
Modeling and Simulation	-Same risks as contained in the Significant Risks for Test and Evaluation -M&S are not verified, validated, or accredited for the intended purpose
Technology	-Program depends on unproven technology for success -- there are no alternatives -Program success depends on achieving advances in state-of-the-art technology -results in less than optimal cost-effective system -makes system components obsolete

	-Technology not proven in required operating environment -Technology relies on complex hardware, software, or integration design -Program lacks proper tools and modeling and simulation capability to assess alternatives
Logistics	-Inadequate supportability late in development or after fielding, resulting in need for engineering changes, increased costs, and/or schedule delays -Life cycle costs not accurate because of poor logistics supportability analyses (LSA) -LSA results not included in cost-performance tradeoffs -Design trade studies do not include supportability considerations
Production/ Facilities	-Production implications not considered during CE Phase -Production not sufficiently considered during design -Inadequate planning for long lead items and vendor support -Production processes not proven -Prime contractors inadequate plans for managing subcontractors -Facilities not ready for cost-effective production -Contract offers no incentive to modernize or reduce cost
Concurrency	-Immature or unproven technologies will not be adequately developed prior to production -Production funding will be available too early-before development effort has sufficiently matured -Concurrency established without clear understanding of risks
Capability of Developer	-Developer has limited experience in specific type of development -Contractor has poor track record relative to costs and schedule -Contractor experiences loss of key personnel -Prime contractor relies excessively on subcontractors for major development efforts -Contractor will require significant capitalization to meet program requirements
Cost/Funding	-Realistic cost objectives not established early -Marginal performance capabilities incorporated at excessive costs--adequate cost-performance tradeoffs not accomplished -Excessive life cycle costs due to inadequate consideration of support requirements -Significant reliance on software -Funding profile does not match acquisition strategy -Funding profile not stable from budget cycle to budget cycle
Schedule	-Schedule not considered in tradeoff studies -Schedule does not reflect realistic acquisition planning -APB schedule objectives not realistic and attainable -Resources not available to meet schedule
Program Management	-Acquisition strategy lacks adequate consideration of various essential elements; e.g., mission need, test and evaluation, technology, etc. -Subordinate strategies and plans are not developed in a timely manner nor based on the acquisition strategy

-Proper mix (experience, skills, stability) of people not assigned to PMO or to contractor team
-Effective risk assessments not performed or results not understood and acted upon

When realized, significant risk events will normally impact cost, schedule, and performance. The risk areas are usually interrelated. For example, a program with high technology risks will often have high design, engineering, and/or manufacturing risks. Conversely, manufacturing and support risks may be reduced by increasing emphasis on integrated design, manufacturing and support processes through concurrent engineering, i.e. Integrated Process and Product Development (IPPD). With the heavy emphasis in acquisition reform on Cost as an Independent Variable (CAIV), cost (and cost risk) will be more of a constraint on performance and its associated performance/technical risk. In addition, for Automated Information and C^4I Systems, the PM must also coordinate with the Defense Information Systems Agency (DISA) to ensure open systems architecture, interoperability, and their associated risks are considered.

Risk Management and Program Management

The basic responsibility of the program manager is to achieve acceptable program performance within cost and schedule goals. It would be nice if all we had to do to accomplish this was to carefully execute the acquisition strategy. It isn't that easy. Acquisition is an inherently uncertain and risky business. Managing that risk is a basic responsibility of every program manager; in fact some say that **program management is risk management**!

Since program risk is directly related to the uncertainty in the program's ability to meet cost, schedule, and performance goals, it must be measured relative to these goals, and within the context of the program's acquisition strategy. Changing the strategy -- changes the risk (unrealistic program strategies can infuse as much risk into a program as using advanced technologies). Development of a realistic acquisition strategy that recognizes and accounts for program risk is by far the most effective risk management technique and it must be an integral and continuing part of the general program planning and control processes.

For a manager to best manage risk, s/he must understand:

- What adverse events may occur for each program WBS element within the areas/sources of risk.
- The likelihood (probability) of the adverse event occurring.
- The severity of the cost, schedule, and performance consequences/effects. 4

Given this level of understanding, the manager is in a position to seek ways to do one or more of the following:

- Make it less likely that the risk will occur and/or reduce the cost, schedule, and performance effects of the risk event in ways that minimize damage to the program. (**Control**)
- Accept the risk as reasonable, given the cost, schedule, and performance advantages of the acquisition strategy and allowable trade space between objectives and the program's minimum acceptable requirements. (**Assume**)
- Reducing the requirements or adopting another strategy that is less risky. (**Avoid**)
- Purchase warrantees or incentives for the contractor to control and assume the risk. (**Transfer**)

[4]When we say that a risk event has certain cost, schedule, and performance consequences, we are describing the set of program cost, schedule, and performance actions we would take in response to that event if nothing else changed in our strategy. We assume this is the set that minimizes the damage to the program given that the risk event has occurred.

As you examine the risk management process, put yourself in the position of the program manager. Think about the information you need to effectively and efficiently allocate scarce time and resources. Ensure you understand how the process will provide that information, and how you would use the process to make decisions relative to cost, schedule, performance, and risk trade-offs. Depending on the level of uncertainty, you may find that additional research and analysis is required prior to making a comfortable decision on how to handle risk.

Government and Contractor Roles in Program Risk Management

Prior to program initiation and contractor selection, the Government's initial risk management role is to define the requirement, choose the best concept to satisfy that requirement, and define the basic acquisition strategy to be used to implement the concept. In doing this, the Government establishes fundamental "show stopper" risks that will challenge that program. It may also be laying out the basic risk management approach the program will take[5], as well as how the risk will be allocated between itself and the contractor.

To the maximum degree practical, industry input should be invited during the initial identification of risks and development of the initial risk management process and plan. The draft Request for Proposal (RFP), which should be sent for industry comment prior to milestone I, is one of the best tools available to help this effort. The draft RFP should ask the contractor to both identify specific risk areas within technical, schedule, and cost, and to provide their risk management approach within their proposal. Since the contractors are best qualified to identify and evaluate the risks associated with a program, they should be intimately involved in risk management prior to and when selected. If they assist with developing the risk management and handling strategy, not only should the risk abatement plans be more feasible, the contractor should also be better motivated to manage them.

The government must coordinate it's efforts with the contractor to ensure the plan is neither too optimistic nor developed to meet contractor generated political goals and timelines. As the program matures, the contractor should progressively move toward leadership in the risk management program. However, just as the government can never totally transfer risk, it should never totally transfer risk management responsibility to the contractor. The government program manager must retain the ability to continuously assess and manage the program's risk.

Risk Management Process Model

Overview. The remainder of this teaching note will be based on a model of the risk management process and it's logical steps. The model will enable you to evaluate and organize risk management in your program office. Though the model is presented in a linear fashion, it is recognized that this is a simplification. In reality, some of the process steps may occur simultaneously, and the process flow may even reverse itself at times as new information is received that changes perceptions. Nonetheless, this model can be applied to any risk management situation.

At the top level, this risk management model is based on a simple and common sense sequence of risk management actions (figure 1 below). First, we organize and prepare the program management office for the effort (**Risk Management Planning/Preparation**). Second, we assess the risk events within the confines of the acquisition strategy (**Risk Assessment**). Third, we select and implement specific responses to these risk events and choose those that are best for mitigating their impact on the program (**Risk Handling**). Finally, we monitor and report the specific responses as a part of the plan in order to determine if our risk handling responses are on track (**Risk Monitoring/Reporting**). We will iterate these risk management actions as the program proceeds, and as we continually refine and mature our acquisition strategy.

[5]Too often, these risks and risk management decisions are implicit, and are not fully explored as explicit decision parameters.

The risk management model breaks the risk management phases into a more detailed series of process steps. For each action, we will describe the process and the products from the viewpoint of the product customers[6]. The customers of the risk management process are both internal and external to the program office. Internally, the process should support the information and decisionmaking needs of the program manager and the key functional managers in both the government and contractor program offices. Externally, it should support the needs of key decisionmakers (e.g., PEO, MDA, Congress) and their staffs.

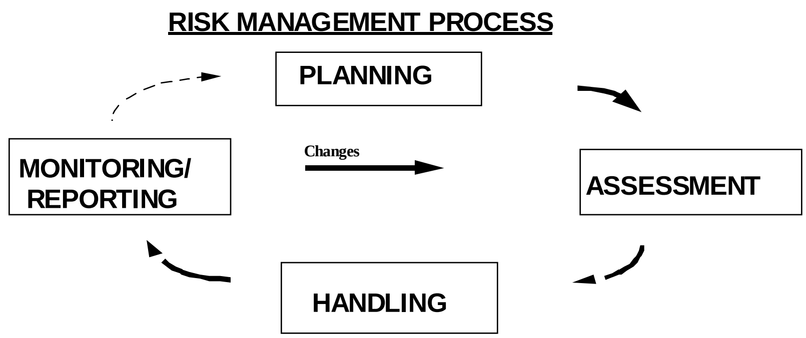

Figure 1

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The key to this process model is an explicit identification of risk management products (such as a risk watch list and a risk management plan). For each customer, we should answer the following questions:

- Who are the customers? (This needs to be defined first.)
- What risk management products does the customer need in order to meet their management responsibilities?
- How will s/he use those products?
- How should the product be tailored in order to best support the customer's needs?
- How should the process be tailored to produce the product needed by the customer?

Now we are ready to discuss the details of the risk management model.

[6]It is important to understand the products associated with each process, as well as the intended customer for that product. This helps us to develop a risk management plan that actually reflects what the program manager needs.

Risk Management Planning/Preparation

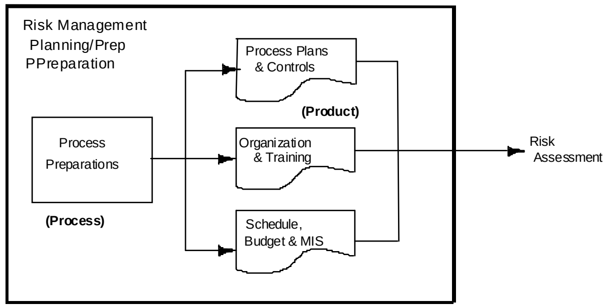


Figure 2

Initial planning and preparation by the program manager should focus on the assessment phases of risk management. Integration of assessment and handling efforts with the acquisition strategy is essential, and should be noted as a risk management project objective. In order to be effective, the preparation team must:

- Develop an organized, comprehensive and iterative approach to risk management. The first step in that process is to define the program's situation in terms of the resources, time, and expertise available to support risk management, and the types of risk with which the assessment team will be working.

- Establish risk management goals and objectives. Identify, evaluate, and choose those risk management tools and techniques that are feasible and best support program goals and needs.

- Organize and train Integrated Product Teams (IPT) to ensure consistent assessments of program risks in a format supporting program management. This training is more important than most people realize and short courses are available to provide risk management procedures and techniques. Unless everyone on the IPTs conducting risk assessments use the same definitions and comparable criteria for identifying and quantifying risks, it will be impossible to compare, rank, and consolidate them effectively.

- Establish cost, schedule, and performance monitors and controls to bring the risk management products shown in Figure 2 in when they are needed. At the same time, assign risk assessment, monitoring and control responsibilities to IPT members.

- Establish a Management Information System (MIS) to document the analyses and decisions as they occur and to disseminate them to the program workforce.

Risk Assessment

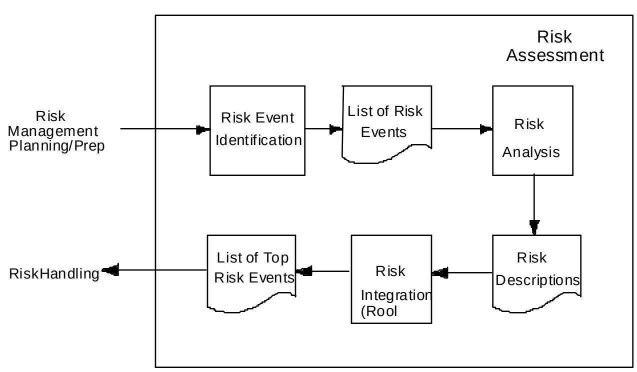


Figure 3

Risk assessment is accomplished by integrated product/process teams (IPTs) with the expertise to evaluate risk within their product/process areas. Their objective is to identify and evaluate events or circumstances that may have an adverse cost, schedule, or performance effect on the program. Generally, this is done by breaking the program into elements small enough to analyze effectively[7], and then:

- Identifying and describing events or circumstances having adverse effects (**Risk Event Identification**).

- Analyzing them to determine their likelihood of occurrence and the severity of their cost, schedule, and performance consequences/effects/impacts (**Risk Analysis**).

- Ranking and integrating the events to produce an assessment for each element. The elements are cumulated/"rolled-up" to higher levels until ultimately a program level assessment is achieved (**Risk Integration**).
- Sometimes the results of this phase are provided in a separate document or report.

Let's look at these steps in the Risk Assessment Phase in greater detail below:

- Risk Event Identification

The objective here is to identify possible events and circumstances that will have an adverse impact on cost, schedule, and/or performance. We are not, at this point, seeking to quantify the degree of risk[8]. In order to do this, we need to identify a management structure to describe the program and:

- Break the program into elements small enough for evaluation.

- Support integration of risk assessments from lower levels to higher levels up to and including the program level.

- Allow collection, processing, and dissemination of risk related data in a form that best supports program management.

A common practice and method for this organization is the program Work Breakdown Structure[9]. The WBS is a recognized planning, organizing, and controlling framework that completely describes the program, provides an accounting structure, and helps us guard against double-counting, that is, overstating risk by counting the same risk against more than one program element or activity. Importantly, the WBS is already required for most programs as a cost, schedule, and performance organizing and accounting vehicle. Using the WBS encourages integration of risk management into the overall management structure of the program[10].

Each element of the structure is analyzed to identify things that could go wrong (**risk events**). (Something that could go right as a result of an uncertain happening or event is normally referred to as an "opportunity.") Expert

[7]The size of the elements into which the program is divided for assessment generally depends on the maturity of the program. The earlier in the acquisition process, the less the number of divisions. Using the Work Breakdown Structure (WBS) as an example, the pre-milestone I assessment might be at level four for hardware elements and at level three for all other elements. The pre-milestone III assessment would be conducted at much lower levels (and consequently in more detail).
[8]Although quantification of the chances and impacts of the risk event is not desired at this step, some analysis is occurring, at least implicitly. By assigning no risk to some elements or by disregarding a risk event as insignificant, the risk assessment IPT is saying, in effect, that the risks associated with that element is either highly unlikely to occur, or that its effects are negligible.
[9]See MIL-HDBK 881 for more information on the Work Breakdown Structure as a program planning and control tool.
[10]Although the WBS is the preferred organizing structure, a WBS often is impractical early in the CE phase, when a product has not yet been defined. Risk evaluations instead may be at the program level or may use a requirements-oriented structure to support exploration of alternative concepts. A proposed Program WBS following guidance in MIL-HDBK-881 should be a deliverable from each contractor in the CE phase.

judgment is one of the most common tools used in this type of analysis. There are numerous techniques and tools, including brainstorming, Delphi, and nominal group, that can be used to augment and support expert judgment. Computer and physical modeling, prototyping, developmental testing, and science and technology projects are used to identify potential risks and areas of uncertainty. Later in the acquisition program, cost and schedule variance analysis, and Technical Performance Measurement results can help to identify developing risk areas.

Consideration should be given to the maturity of the chosen technologies (including manufacturing technologies), the uncertainties associated with all input requirements (raw materials, preceding events, etc.), cost and schedule assumptions (labor rates, contract costs, inflation, etc.), and the number and complexity of interfaces. The analysis should consider the risk events identified for each element over the entire life of the program, within the sources of risk described earlier in this teaching note. A complete risk evaluation will consider all risk sources for all program elements over all program events. Figure 4 illustrates the relationship of WBS elements, sources of risk, and risk events.

Risk Evaluation Cube

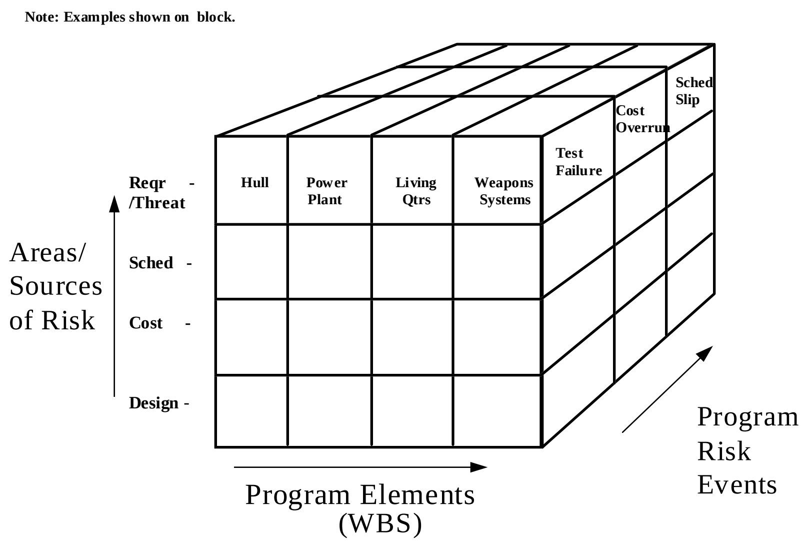


Figure 4

The identification of the risk events should be in such a form that the customers can understand:

- The circumstances causing them to occur,
- How to recognize them, and
- How they will affect cost, schedule, and performance.

- Risk Analysis

The objectives of risk analysis are to: quantify the **consequence** and severity of the risk event's occurrence, estimate the likelihood (**probability**) of the event, and identify relationships between risks. Program management planners, controllers and decision makers require this information in order to decide if they will accept the risk, or if they will try to reduce the risk by trading off cost, schedule, and/or performance.

The **consequences** or impact of each risk event must be described in terms of the cost, schedule, and performance effects on the program. Values used in these descriptions may cover a range (e.g., "if this risk event occurs, cost will increase to a value within the range $xxx to $yyy"); or they may be covered by a qualitative descriptor such as "critical, serious, moderate, minor, or negligible" (with appropriate cost and schedule definitions). Consistent process and format must be used so that risk events can be compared across elements and their consequences consolidated and rolled-up from lower levels to higher levels. Techniques to help quantify consequences include expert judgment, critical path analysis, computer modeling, and Monte Carlo analysis.

Understanding the **probability** of a risk event occurring is also important to the decision making process. If it is not possible to provide specific probability values for the event, subjective probabilities may be assigned or qualitative descriptors, such as "high", "moderate", and "low" may be used to represent a range of probabilities. However, the values associated with these qualitative descriptors must be defined to ensure consistency of evaluation and accurate communication (e.g., "low probability of occurrence will mean a less than 10% chance, moderate probability of occurrence will mean between 10% and 30% chance, etc.").

Techniques for establishing a range of probabilities include modeling and simulation, expert judgment, and comparison with previous efforts. Trying to establish a probability range in which you have a measure of confidence can be one of the most difficult parts of this process. The effort that is expended to understand the probabilities improves the risk management team's knowledge and comprehension of the risks in a program. It is up to the program office to define the ranges of probabilities used in risk descriptors. These definitions must be presented whenever risk is discussed so that those outside of the program office understand their meaning.

There should be some estimate of the confidence that the analyst has in each risk quantification. This may be expressed using confidence intervals, or by defining percentage ranges for "high", "medium", and "low" accuracy (for example, high accuracy might mean that the analysts feels "confident" that the actual value is within + or - 10% of the estimate).

Although a single qualitative term may be used to represent the combined effect of the **probability** and **consequences** of a **risk event** (see following section on "Risk Integration"), their separate values must be retained. Without these values, decision-makers have a difficult time conceptualizing and responding to these events as actual possibilities. Moreover, a single value that combines probability and consequence may produce a ranking of risk, which may not be consistent to what would be obtained, if the values were identified separately. A simple, but effective technique to quantify subjective risk is shown at **attachment 1** to this teaching note. This technique is an adaptation of a commercial model currently (1997) used by the Carrier Corporation, a subsidiary of United Technologies.

- **Risk Integration**

The objectives of this process step are to integrate risk events from lower level elements to higher levels, and to rank them in order of their potential to damage the program. Integration allows us to focus on the major program elements that contain the most risk, and to recognize the effect of cumulating the risks[11]. Actions by the team during the integrating effort can infuse risk into the program. They should be carefully considered at this point if they were not considered as a separate program element.

[11] An element which has many small risks may have a cumulative risk higher than that of an element with a few moderate or even high risks.

Risk ranking is required to best allocate scarce program assets. Because of the potential size and complexity of this process, the initial objective is to decide which risk events will receive detailed handling option analysis[12]. Once the risks have been reduced to the most practical extent, risk ranking can be used to focus top management attention on those risk events that have the greatest potential for harm. The cost of handling a specific risk event will also help determine risk ranking. For example, if two risk events were rated as equally high risk, but one was mitigated very cheaply, that risk event would be addressed first.

Program damage depends on the probability and the severity of the consequences. Both must be considered in the ranking process. Methods for combining these parameters include those which combine the probability measure and consequence measure (e.g., expected value, product of risk values[13], etc.) and those using a matrix to group risks in bands. This matrix (figure 5) is an example of one which might be used to rank principal program risks. In this example, taken from the Air Force Material Command Risk Management Guide, the program element (and its risk events which are not shown) is described in the matrix cell, with the row identifying the probability of experiencing an adverse cost or schedule outcome relative to that element/event, and the column identifying the severity of the consequences (the number of rows and columns, and the values for ranges should be tailored to each program's needs). High-risk elements would be those in the upper right portion of the matrix and low risk elements would be those in the lower left corner.

Consequences

Probability	<3 Mo <$0.1 M	3-6 Mo $0.1-0.5 M	6-9 Mo $0.5-1.5 M	9-12 Mo $1.5-5 M	>12 Mo > $5 M
>0.9		Test Program			Propulsion (Req't)
0-0.9			Support Equipment	Guidance System	Fire Control Equipment
0.3-0.7		Training Equipment		Adapter	
0.1-0.3	Site Activation		Test Equipment	Safe & Arm Device	
<0.1		Warhead*			Industrial Equipment

*** An example of a risk event associated with the warhead could be its "failure upon impact".**

Figure 5

Whatever method is used, the risk identity, stated in terms of the risk event and the event's probability and severity of the its consequence, must not be lost. These risk components are necessary to ensure that the risk rankings make sense, so that risk-handling options may be developed and evaluated.

Risk events evaluated for lower level WBS elements should be integrated to produce risk assessments for higher level elements. An integrated assessment at a higher level should show a risk at least as high as the highest risk of any event included in the lower level elements, and must recognize the cumulative effect of all the risk events.

[12]Lower ranked risks will be assigned to lower level management levels for analysis and control.
[13]Take care to clearly define the rating standards. Avoid rating schemes that produce fine distinctions between risk (e.g., risk rating of 3.785) when the process used to estimate probability and consequence do not support that level of accuracy.

The percentage of the risk events that are subjected to a detailed risk handling option analysis depends upon the number of risk events and the resources available to the program office. Those risk events that do not make the cut should still be assigned to the appropriate individual or IPT for continued management.

Once a risk event has been identified, the program manager has two basic options: mitigate or accept the risk. The basic objectives of the risk handling phase are to identify the range of alternative responses in the acquisition strategy to a risk event (**Risk Handling Option Identification**), to evaluate the alternatives relative to their costs and benefits (**Risk Handling Option Analysis**), and to choose those which will result in the best balance between cost, schedule, performance, and risk for the program (**Risk and Risk Handling Option Integration**). It is important to realize however, that risk is not reduced merely by planning to handle it; reduction/mitigation occurs when the handling action actually takes place. Let's look at each of these process steps.

Risk Handling

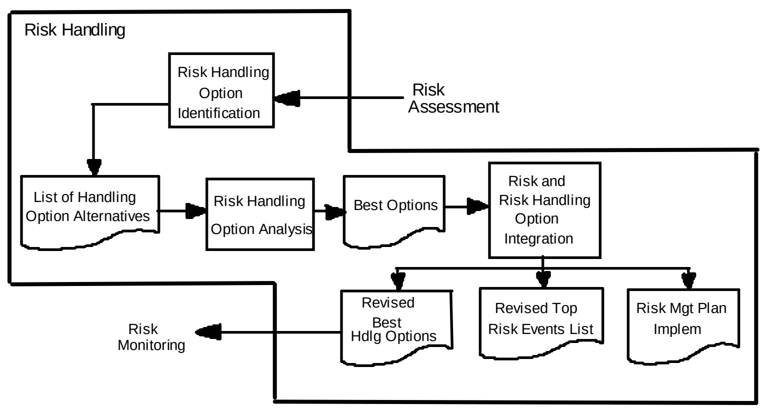


Figure 6

- Risk Handling Option Identification

The objective of this process step is to identify the potential risk handling options for dealing with the risk event under consideration. It is important to make an effort to identify a range of handling options for each event. This identification effort forces the manger to a more objective consideration of the costs and strategy alternatives available.

There are five ways of handling risks. These include **Control, Assume, Avoid, and Transfer**. A good way to remember them is by using the acronym **"CAAT"**. Each of these risk-handling options should be considered

Control options establish fallback positions to minimize the effects of a risk event should it occur, as well as a control system that allows the manager to institute the fallback option in time. For example, a parallel development effort might allow the program to attain performance objectives if a primary effort fails. A Technical Performance Measurement system that tracks key risk indicators could be instituted to give the program manager adequate time to react if a risk event occurs. There are usually some cost or schedule trade-offs involved in establishing a risk control handling option.

Assume the risk without reducing either the probability or the severity of the consequence. This approach usually calls for a cost, schedule, or performance "trade space" that can be used if the risk event occurs. It may include acceptance of the possibility of program failure.

Avoid risk by trading off cost, schedule, or performance. Examples include: reduce performance objectives, use more expensive material, or increase the time allotted for an action. Risk avoidance options make it improbable that the risk event will occur.

Transfer the risk to some other element or organization usually with a cost, schedule, or performance trade-off. Examples include fixed price contracts (NOT REALLY??) and warranties, that transfer cost risk to the contractor (but not schedule or performance risk[14]) in exchange for additional cost to the program, or a re-allocation of performance requirements from one program hardware or software element to another, possibly with a reduction in risk and an increase in cost.

Research and Analysis. Since risk is a function of probability and consequence, additional research and analysis (R&A) provides an opportunity to reduce the uncertainty associated with each identified risk event. R&A, also identifies unknown risk events previously undiscovered. Developmental test and evaluation is a good example where more is learned about probability and consequences of failure in system designs. As we learn more about the risk events, we can then update our risk priorities and migrate to one of the risk handling options such as control (including fixing the cause of the risk event), assumption, avoidance, and transfer. R&A is the precursor to the actual handling and mitigation of risk and provides the logic and basis for the Program Definition and Risk Reduction (PDRR) phase of the life cycle.

The risk templates contained in DoDD 4245.7-M may be used as a guide for identification of risk handling options, especially during the period which begins with preparation for Milestone III.

- **Risk Handling Option Analysis**

The objective of this analysis is to identify those risk handling options that are feasible and that reduce risks to acceptable levels with the best cost/benefit ratio. Quantification of costs must consider all of the direct and overhead costs associated with the risk handling option, including additional personnel, schedule considerations, ranges and facilities, and data collection, processing and reporting.

Benefits of each risk handling option are quantified by modeling the application of an option to a risk event, and then applying the same techniques we originally used to quantify probabilities and consequences of that event to obtain a new result. It is important to apply the same consistency to obtain valid data for comparison.

Most risk handling options will not completely remove the risk. The remaining risk must be identified in the same terms, format, and degree of detail as was used for the original risk evaluation. Once risk handling options are chosen, the remaining risk will carry over into the program risk description.

From the viewpoint of the program decision makers, each risk handling option is an alternative action plan that modifies the acquisition strategy based on its own set of cost, schedule, performance, and risk. The risk handling option analysis results should be structured to allow decision makers to compare these parameters.

Identified risk events are often called "**known-unknowns**". In other words, we can identify an adverse event that may occur, but we are uncertain as to its probability and/or the severity of its consequence. Risk analysis helps us to better understand the "known-unknowns". Other adverse events may occur that were not anticipated. These are called "**unknown-unknowns**", meaning that we can neither identify the event, its probability, nor its consequence.

[14]There is a tendency to think that transferring a risk to a contractor removes that risk from the program. This is seldom the case. If the contractor fails to perform, the government may not incur any additional costs, but the program will still have failed. Schedule and performance risks which remain after transfer of cost risk to the contractor must be recognized and managed by the government.

Dealing with unknown-unknowns is a challenge for every program. One way to do so is to compare the final program cost and schedule plan, after adjustment for known risk events, to the cost and schedule results of other comparable programs. After making adjustments for differences between the acquisition strategies, the remaining cost and schedule difference can be used as an indicator of the effect of unknown-unknowns. Management reserve is the only way to handle these potential risk since, by definition, there is no way to determine the risk information needed to develop other responses.

We should not overlook the fact that "**known-knowns**" also involve risk because we know that the uncertain event will occur, and we also know the probability and severity of the event's consequences. However, we better understand the level of risk than in the case of "known-unknowns".

It should be clear that integration of risk handling option analysis with all other program planning and controlling activities is essential. On the one hand, if those doing the risk handling option analysis are unable to affect the acquisition strategy, their range of options will be very limited, On the other hand, if the program planners are not fully aware of the risks involved in their strategy options and of the alternatives which might be available to reduce risk, it is unlikely that they will develop the best acquisition strategy.

- **Risk and Risk Handling Option Integration**

The objectives of this process step are:

- To integrate the analysis of the lower level risk handling options into program level options that are feasible and that provide the best total balance between cost, schedule, performance, and risk for the entire program.

- To produce and implement a living program risk management plan that honestly describes the risks facing the program and their risk handling methods.

Integration is necessary to identify the cross-element effects of risk handling options. An option that does not provide the best cost-benefit ratio for a single element may be the best choice when its risk reduction effects on other elements are considered.

All functional areas should be represented within the IPTs during this process step to ensure that the effects of handling the options and the evaluation of the remaining risk events consider the needs of the entire program.

Two of the principal products of this step will be the revised top risk events list (revised watch list) and the risk management plan. The revised list will include the top program risk events, their potential consequences/effects on the program, the probability of their occurrence, and the risk handling options put in place to deal with them. The risk management plan along with program risk handling processes and management reserves should be oriented to maintain visibility and deal with these events.

The integration process should produce a program level risk assessment (revised top risk list) which describes the cost, schedule, and performance consequences/impacts after planned activities to mitigate the risk, i.e. the program's acquisition strategy, have been implemented. The intent is to give program decision makers a well grounded understanding of the uncertainties associated with their program and the planned effects of the mitigation effort. At the least, program decision makers should be briefed on the principal risk events that will still exist after risk handling is applied, their possible effects on the program, and the plans for dealing with them. In many cases a "waterfall" schedule is developed which depicts risk mitigation activities and the reduction of risk over time.

Risk Monitoring/Reporting System

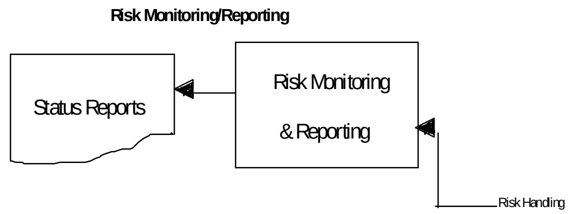


Figure 7

The risk handling options chosen by the empowered IPT and implemented in program management plans will form the basis for development of the risk monitoring/reporting system; See Figure 7. Ideally, the risk monitoring/reporting system will be an integral part of an overall cost, schedule, performance, and risk control system designed to support program management.

The objectives of the risk handling system are to:

- Continuously assess risk events in order to provide current risk information to support program decision makers.

- Ensure that risk stays within acceptable limits.

The risk monitoring system is targeted toward results from the application of risk handling options, monitoring those risk events that remain after application of risk handling options, and identification of unknown risk events yet to be detected. It should include the elements of an effective management control system and be designed to support the decision makers by providing only that information needed for the decision in a format tailored to the needs of the decision maker.

The monitoring system should include an identified standard and baseline, a means to collect data to allow comparison of progress relative to that standard and baseline. The frequency of the collection of data should be in line with the frequency of the decision supported and the time required if action is necessary.

To be effective, risk monitoring and reporting should follow these principles:

- Be closely related to Earned Value Measurement and program control functions (cost, schedule, and performance measurement reports).

- Systematically track and evaluate performance of identified risk areas and events against established metrics throughout the acquisition process. A good technique for this is Technical Performance Measurement (TPM), when the latter is tied to testing events.

- Hold periodic Integrated Product Team meetings/assessments and Integrated Baseline Reviews (IBR). The IBR is a key activity of the Monitoring and Reporting Phase. The purpose of the IBR is to ensure that the baseline captures the entire technical scope of work; is consistent with contract schedule requirements; and has adequate resources assigned to handle risk. It is normally conducted by the Program Manager no later than six months after contract award. The technical staff is heavily involved. The Earned Value Management System (EVMS) Field Command (DCMC) Focal Point and program office financial personnel will provide support to the Program Manager and Technical Staff during this review.

- Place heavy emphasis on the Defense Acquisition Executive Summary (DAES) and Selected Acquisition Reports (SAR) for Major Defense Acquisition Programs.

- Factor risk into the milestone decision process. A Milestone Decision Authority (MDA) - at any ACAT level - is always interested in program risk.

Risk Re-Assessment

Iterative assessment is critical to program success. It updates the status of known risk events and adds newly identified events to the risk management process as they are discovered. Periodically, the program must formally re-assess risk, using the information gained since the previous effort to define their risk management system. As a minimum, a re-assessment should be done prior to every milestone or whenever there is a change in program managers. Risk must also be re-assessed whenever there is a significant change to the acquisition strategy or its cost, schedule, and performance objectives. Re-assessments require updates to the risk management MIS. By comparing predicted to actual outcomes, the risk management team can identify strengths and weaknesses in their assessment techniques and evaluate the effectiveness of the risk management process. Without this data base, the program will have to re-learn its lessons every time it goes through a new phase. Once the program has a history, that history should be one on the most effective predictors of future performance, risk, and the degree of confidence that can be placed in risk assessments. All risk management lessons learned should be shared with the acquisition workforce via the acquisition deskbook.

The flow of the steps discussed above and the resulting products are shown in the risk management flow chart at **attachment (2)** to this teaching note. You may want to pull that chart out for reference as you develop your program's risk management plan.

Program Risk Management Principles - A Summary.

The following principles summarize the major lessons in this teaching note.

- The primary goals of program risk management are to support the development of an acquisition strategy to meet the user's need with the best balance of cost, schedule, and performance, and to reduce the likelihood of failure by identifying risk events and dealing with them explicitly.

- Poor program planning will exacerbate a program's risk management efforts by establishing unrealistic objectives that do not recognize and account for program risk.

- Risk events must be dealt with in terms of the probability of their occurrence and their effects (consequences) on cost, schedule, and performance.

- High, low, and moderate risk should also be defined in terms of probability of occurrence and cost, schedule, and performance consequences/impact.

- Risk can only be assessed within the context of an acquisition strategy. Change the acquisition strategy and you change the risk.

- Unless the original plan was sub-optimal, risk reduction will almost always involve trading off cost, schedule, and performance.

Risk is defined in terms of Cost, Schedule, and Performance (Technical) Risk. Under the "Cost as an Independent Variable" (CAIV) concept, as cost-performance tradeoffs (including risk) are made on an iterative basis, aggressive cost goals are established that become more of a constraint, and less of a variable. Therefore, the PM may be required to trade performance/technical and schedule - and their risks - to meet CAIV cost constraints and reduce cost risk.

Risk can never be fully eliminated or completely transferred.

- The principal purpose of research and development is to reduce the uncertainty, and thereby the risk, associated with acquiring a new system. In this regard, risk can be considered "good" in that acceptance of some risk opens up "opportunities" for technological breakthroughs.

Commercial and Government computer software models exist to help us better plan and perform risk management. A summary of some widely used models is briefly described in **attachment 3**.

“Rule Based” Risk Assessment*

1. **Project Name:**

2. **Model(s)/Component(s):**

3. **Definitions:**

Levels	Ratings
High Probability and High Consequence of Occurrence	High
Low Probability and Medium Consequence of Occurrence	Medium
High Probability and Low Consequence of Occurrence	Medium
Low Probability and Low Consequence of Occurrence	Low

4. **Assessment Guidelines:**

High Probability: The probability of problems is high if the element has:
- a history of problems in other applications, or...
- questionable capability/reliability test data, or...
- unknown capability/reliability data or tests, or...
- application near or past tested duty limits, or...
- untested duty limits, or...
- New, novel, or unique application duties

Low Probability: The probability of problems occurring is low if:
- No high-probability conditions exist, or...
- Clear actions have been taken to minimize or eliminate inadequate performance/ reliability, and to reliably monitor or qualify performance status.

High Impact: Risks have high impact if failures could:
- Exceed factory or improvement goals for field failure rates (FFRs), Warranty, or Rework
- Limit the support or services of distributors, dealers, installers or repairers.
- Subject customers/users to major inconvenience, chronic annoyance, or significant costs.
- Cause unacceptable project delays or target-margin variances (market price, mfg. cost, or target volume).

Low Impact: Risks have low impact if:
- No high impact conditions exist, or...
- Clear and effective plans are in place to minimize negative consequences and correct root causes.

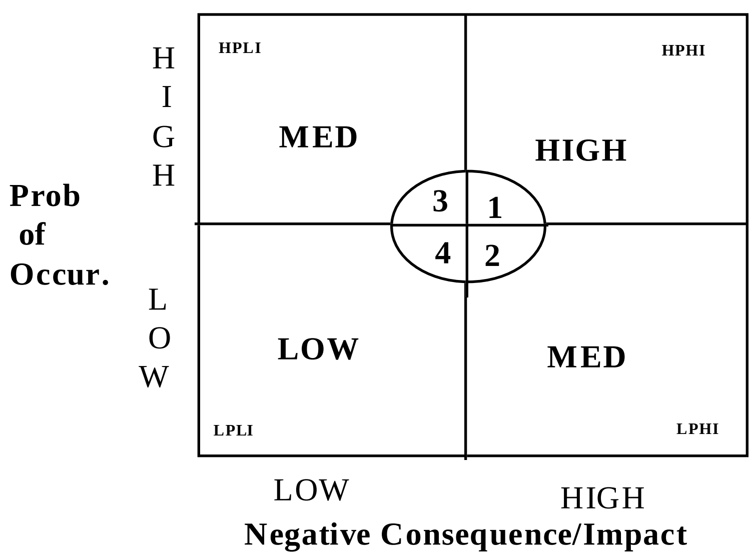
Attachment 1-1

5. Overall Ratings: **HIGH** risks have High Probability and High Consequence/Impact
MEDIUM risks have High Probability but Low Consequence, or Low Probability but High Consequence
LOW risks have Low Probability and Low Impact

6. Systems Requiring Risk Assessment: Any system, product, process, support element or sub-system thereof which is key to a system's deployment and employment success, but uncertain as to its functional capability, quality, reliability, availability, or conformance to requirements. Typically, risk events for these systems impact on or have consequences for program costs and schedule, and on product performance.

7. Risk Classifications/Ratings for risk events:

Risk Classification/Ratings



Note: Blocks 1,2,3 are logical priorities for risk reduction and management attention

Attachment 1-2

8. <u>Assessment Table</u>: (An example)

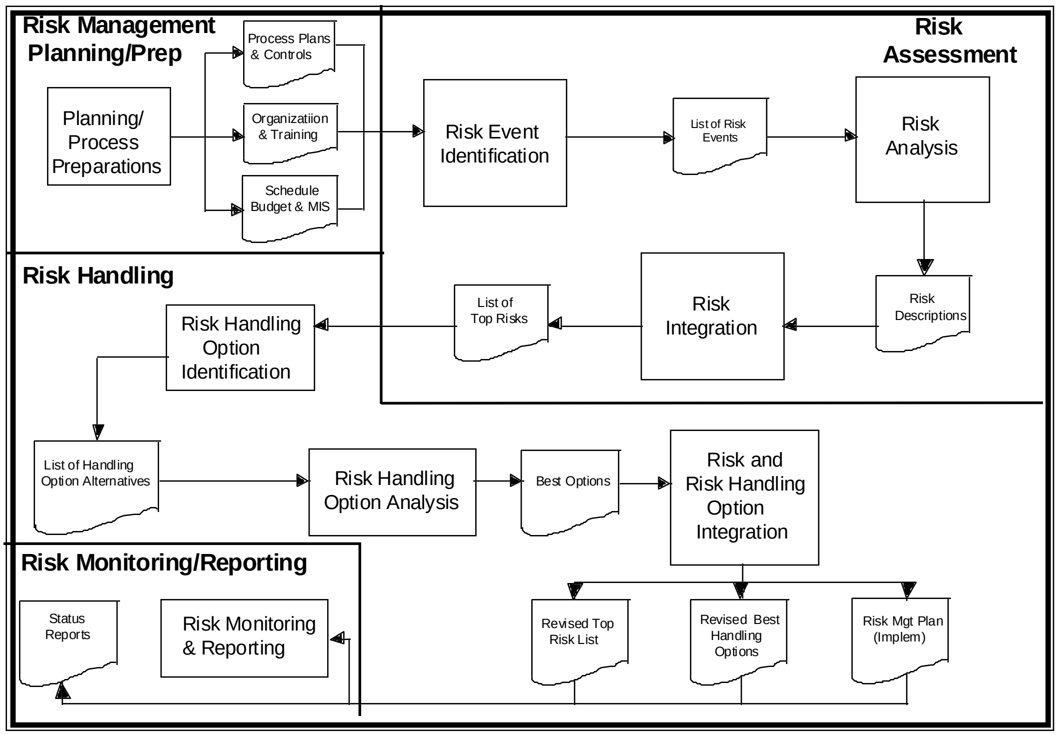
Analysis Worksheet

#	Risk Event Description	Impacts on	Team Resp.- Risk Level				Overall Risk Rating
			HP	HI	LP	LI	
1	Proposed Generator has high diode failures on existing Generator applications (reliability)	Schedule (testing) & Product Cost	X	X			High
2	Single Source (Kubota) for diesel engines (sourcing)	JIT Assembly Process Schedule Reliability		X	X		Med
3	Unit Frame is too large & heavy for the powder-painting process conveyor (manufacturing)	Product Cost & Quality Control Reqr's	X			X	Med
4	Unclear if User Reqr for 120 U.S. Gal fuel tank is to meet run-time needs or competitor's spec's (Design)	Testing & Marketing Emphasis			X	X	Low
	Etc.						

(Carrier Corporation calls this risk assessment methodology "rule based" because it has a set of rules or guidelines to help determine risk levels.)

Attachment 1-3

Risk Management Process Model



Attachment 2

EXAMPLES OF RISK SOFTWARE

RISKTRAK *

A MANAGEMENT TOOL FOR PRIORITIZING, DISPLAYING, AND TRACKING PROGRAM RISK

Prepared for: The MITRE Corporation, beta release version .5, October 1995

Prepared by: The MITRE Corporation, Economics and Analysis Center, 202

Burlington Road, Bedford, Ma. 01730

POC: P. R. Garvey, (617) 271-6002

RiskTRAK is a management tool that aids in identifying where engineering assets are best applied to mitigate potentially crippling areas of risk to a program. The purpose is to provide program offices a structure for conducting continuous risk assessments. It was designed to provide a straightforward way to isolate key critical risk events from those considered less threatening.

Also known as Risk "TRAP" - Technical Risk Assessment Program

Additional information on each of the risk management software packages described herein can be obtained from the Principles of Program Management Dept., DSMC.

RISK MATRIX

A STRUCTURE FOR IDENTIFYING AND PRIORITIZING PROGRAM RISKS.

Prepared for: U.S.A.F.

Prepared by: Department of the Air Force, Headquarters ESC (AFMC),

Hanscom AFB, MA, 01731-5000

POC: P. R. Garvey, MITRE, (617) 271-6002

Risk Matrix was developed by the Electronic Systems Center (ESC) to provide a structure for identifying and prioritizing program risks. It facilitates the thought process of identifying risks and provides a structured way to prioritize, evaluate, document, and manage the impact of key risks on projects.

Attachment 3 - 1

ANALYTIC COST PROBABILITY MODEL (ACOP)

PRESENTS THE FOUNDATIONS OF A RECENTLY DEVELOPED ANALYTIC APPROACH TO SYSTEM COST UNCERTAINTY ANALYSIS.

Prepared for: Publication in "Cost Analysis in Transition - Shifting US Priorities," SPRINGER - VERLAG, NEW YORK, June 1991

Prepared by: The MITRE Corporation

POC: P. R. Garvey, (617) 271-6002. The MITRE Corporation, Economics and Analysis Center, 202 Burlington Road, Bedford, Ma. 01730

This paper presents the foundations of recently developed analytic approach to system cost uncertainty analysis. The approach is referred to as the Analytic Cost Probability (ACOP) model; and its structure is sufficiently general to meet the characteristics of any program definition. The analytic nature of the ACOP model facilitates the identification of cost variance drivers and measures their overall impact on the system cost.

ANALYTIC SOFTWARE EFFORT PROBABILITY (ASEP) MODEL

PRESENTS THREE METHODS WHICH QUANTIFY THE EFFECTS OF UNCERTAINTY IN SOFTWARE DEVELOPMENT EFFORT

Prepared for: The MITRE Corporation

Prepared by: The MITRE Technical Report MTR 10212; Garvey, Paul, R., May 1987

POC: Paul R. Garvey, (617) 271-6002

Software development effort estimates have several major sources of uncertainty. Among these uncertainties are the size of the project, the development attribute ratings, and the error of the estimation model. This paper presents three methods that quantify the effects of these uncertainties on development effort estimates.

Attachment 3-2

BIVARIATE COST-SCHEDULE PROBABILITY MODELS

PRESENTS AN APPLICATION OF BIVARIATE PROBABILITY THEORY

Prepared for: The MITRE Corporation, Journal Publication Source MORS, July 1996

Prepared by: The MITRE Corporation, P. R. Garvey

POC: Paul R. Garvey, (617) 271-6002

This is a paper that presents an application of BIVARIATE probability theory to modeling cost and schedule uncertainties. It has long been recognized that program cost and schedule estimates are correlated; however, formal methods have not been developed in the cost analysis community to study their joint behavior, To address this, BIVARIATE models for approximating the joint and conditional probabilities of program cost and schedule estimates are presented. Specifically, the BIVARIATE lognormal and BIVARIATE normal-lognormal models are discussed. The statistical properties of these models are provided. A cost analysis application is presented to illustrate their use in a practical context. Methodology described can be programmed in an Excel spreadsheet.

STAGE-WISE REGRESSION MODEL

A SYSTEMATIC APPROACH FOR CONSTRUCTING A TOTAL COST EQUATION USING THE STAGE-WISE REGRESSION PROCEDURE.

Prepared for: The MITRE Corporation

Prepared by: Chien Ching Cho, Leah M. Gaffney, The Journal of Cost Analysis, fall 1996

POC: Chien Ching Cho, Leah M. Gaffney, (617) 271-6287

A frequently used methodology in cost estimating is the use of linear cost estimating relationships between prime mission product (PMP) and non-PMP costs such as test and program management. When assessing the uncertainty associated with such an estimate, it is often improperly assumed that the cost components are either totally independent or perfectly correlated. These simplifying assumptions could lead to a large error in the construction of the total cost distribution, thus significantly impacting the ensuing risk assessment. This paper presents a systematic approach for constructing a total cost equation using the stage-wise regression procedure.

C-RISK - COST RISK

PRODUCES AND JUSTIFIES COST - PROBABILITY DISTRIBUTIONS OF WBS ELEMENTS AND CORRELATION BETWEEN THEIR RISK-RELATED BOUNDS.

Prepared for: The Air Force Space and Missile Center (AFMC/SMC) and the Aerospace Corporation. Version 3.0, 1994

Prepared by: The Aerospace Corporation. Mail Station MM4-021, PO Box 92957 Los Angeles, CA 9009-2957

POC: Stephen A. Book, (310) 336-8655

The Air Force Space and Missile Systems Center (AFMC/SMC) and the Aerospace Corporation originally developed C-RISK for in-house use. It is now available upon request to all U.S. Government Agencies and their contractors. Its objective is to produce and justify cost-probability distributions of individual work-breakdown-structure (WBS) elements and correlations between their risk-related bounds. The resulting distributions and correlations can then be input into FRISK, Crystal Ball, @Risk, or other commercially available software to compute the probability distribution of total cost.

TRL-RISK-TECHNOLOGY-READINESS-LEVEL-BASED RISK ANALYSIS

A COST-RISK ANALYSIS PROCEDURE

Prepared for: NASA, Version 1.0, February 1996

Prepared by: The Aerospace Corp. Hallmark Building 13873 Park Center Road Herndon, VA 22071

POC: Erik L. Burgess, (703) 318-2477

TRL-RISK is a cost-risk analysis procedure for using NASA's "Technology Readiness Level" (TRL) as a useful metric for expressing technology/design maturity. The TRL serves as a quantitative input into the cost-risk analysis process. It has been implemented as part of the Small-Satellite Cost-Engineering Model (SSCEM) under development for NASA's Jet Propulsion Laboratory (JPL).

METHODS AND METRICS FOR PRODUCT SUCCESS

A GUIDE TO TECHNICAL METHODS AND METRICS WHICH HAVE PROVEN SUCCESSFUL IN PRODUCT DEVELOPMENT.

Produced for: Assistant Secretary of the Navy (Research, Development and Acquisition)

Produced by: Willis J. Willougby Jr., Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) 2000 Navy Pentagon, Washington D.C. 20350

POC: D. Porter (703) 602-5506

Attachment 3 - 4

Produced in July 1994, the book is an attempt to guide government and industry toward an understanding of those technical methods and metrics, which have been proved over time to ensure an successful product. The focus is in the technical process that will supplant milspecs as the basis for military acquisition. Use of proven best practices and the management of the technical process comprising design, test, and production discipline are combined in the belief that management of these process will reduce many other types of risk.

COST-RISK IDENTIFICATION AND MANAGEMENT SYSTEM (CRIMS)

PROVIDES A MEANS TO IDENTIFY THE COST IMPACTS ON PROGRAM DUE TO RISK.

Prepared for: The Air Force Material Command Space and Missile Systems Center.

Prepared by: Space and Missile Systems Center, Financial Management and Comptroller 2430 E. El Segundo Blvd. Suite 2010, El Segundo, Ca, 90245-4687

POC: D. R. Graham (SMC/FMC) and J. Dechoretz (MCR) (310) 363-0131

CRIMS was developed as a means to identify the cost impacts on a program due to risk. Its use enables analysts to quantify the impact of technical and schedule uncertainty, positively differentiate between the different drivers of acquisition cost change, and to track risk driven cost change to better predict future outcomes.

FRISK - FORMAL RISK ASSESSMENT OF SYSTEMS COST ESTIMATES

PROVIDES A MEANS FOR QUICK RESPONSE TRADE STUDIES.

Prepared for: Air Force Space and Missile Center (AFMC/SMC)

Prepared by: The Aerospace Corporation., PO Box 92957 Los Angeles, CA 9009-2957, Version 3.2, Sep 1992

POC: Stephen A. Book, (310) 336-8655

Cost estimates are typically derived by determining low, best estimate, and high cost for each of several cost elements in a Work Breakdown Structure (WBS) as a result of technical risk assessment after which a statistical distribution, such as a triangular, is
postulated for each element cost. Means, variances, and typical percentiles can be derived from the statistical distribution. Dependencies among cost elements can be quantified in terms of a correlation matrix. Then the distribution of the sum of the element cost is determined, typically by a Monte Carlo sampling technique.

CRYSTAL BALL 4.0

A MANAGEMENT TOOL FOR FORECASTING AND RISK ANALYSIS

Prepared for: Commercial sale

Prepared by: Decisioneering, Inc. 1515 Arapaho Street, Suite 1311, Denver, Colorado, USA 80202

POC: Decisioneering, Inc. Telephone: (303) 534-1515, Facsimile: (303) 534-4818, and Internet: www.decisioneering.com

Crystal Ball is a risk analysis tool that uses Monte Carlo simulation to forecast potential outcomes for a program when uncertainty exists for multiple elements of the program. Crystal Ball acts as a spreadsheet add-in that requires either Microsoft Excel 4.0 (or later) or Lotus 1-2-3 Release 4 (or later). Data are entered as a spreadsheet(s) and then analyzed by the add-in module.

OPEN PLAN PROFESSIONAL™, OPEN PLAN DESKTOP™, AND OPERA

MANAGEMENT TOOLS FOR PROJECT MANAGEMENT

Prepared by: Welcom Software Technology: WST Corporation, 15995 North Barkers Landing, Suite 275, Houston, Texas 77079-2494

POC: Diana M. Melton, (713) 558-0514; e-mail dmelton@wst.com

The Welcom Program Management software package includes Open Plan Professional, a program that uses embedded tools to integrate project management functions across an organization, Open Plan Desktop, which may be used to schedule projects, manage resource requirements, perform " what if" analyses, report earned value, and use corporate wide databases, and Opera, an Open Plan extension for risk analysis.

IPD TOOLKIT

A COLLECTION OF PROCESSES AND SOFTWARE TOOLS THAT PROVIDE INTEGRATED COST, SCHEDULE AND RISK PERFORMANCE MEASUREMENT

Prepared for: Commercial sale
Prepared by: C/S Solutions, Inc. 1324-J State Street # 174, Santa Barbara CA, 93101-1024
POC: C/S Solutions, Inc. Telephone: (805) 653-4951 Facsimile: (805) 563-4961 Internet: www.cs-solutions.com

The IPD tool kit is designed as an aid for the Integrated Product Development Team (IPD) Members. It integrates and customizes off-the-shelf software including MS Project, MS mail, wInsight, C/S glue and Risk +. The IPD tool kit currently supports Windows 3.1, 95. NT and Macintosh.

Attachment 3-6

CASE STUDY
Advanced Production & Quality Management Course
(APQMC)
Ground-to-Air Missile System (GTAMS)
Risk Management Process

This caselet is based on risk management plans compiled from several actual programs. The circumstances have been modified, but it includes clear examples of risk management lessons learned, and provides students with an opportunity to evaluate a hypothetical risk management program. The students are required to recommend process improvements to manage a program's risk within an Integrated Product & Process Development (IPPD) / Integrated Project Team (IPT) environment.

SITUATION

You are the new deputy program manger for an ACAT I, single-service, ground-to-air, anti-missile system whose program structure/schedule was established in the CE Phase and approved at MS I as shown in **Figure 1**.

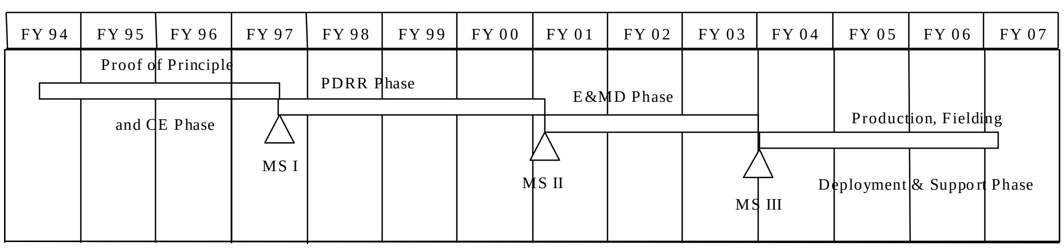


Figure 1

The time now is 1 October, 1997. The program manager reported aboard six months ago. At the PMO meeting this morning, she asked you to review the program's risk management approach and to report on your findings.

BACKGROUND

The program began as an informal "Proof of Principle" (POP) program in FY94. The objective of the POP activities was to identify technological approaches to counter ground-to-ground ballistic and guided tactical missiles. There was no originating milestone decision, per se. During the POP phase, the government and three contractors built advanced technology demonstrators (ATD) and conducted technology demonstrations.

Considering the successes of these technology demonstrations, the program office and the Service agreed on a strategy to provide a detailed RFP as part of a full-and-open-competition solicitation; they also agreed to a plan to down select to one contractor, going directly into EMD. They planned to by-pass the Program Definition and Risk Reduction Phase with a Milestone I/II decision.

Eighteen months before the July 97 Milestone I/II review, the new DoDI 5000.1 and DoD 5000.2-R were signed. These regulations emphasized a formal risk management program. In response, the program office formed a Program Risk Management IPT (PRMIPT), chaired by the PMO Chief Engineer/Engineering Functional Head, which initiated a crash risk management project and produced the current risk assessment and risk management plan.

At the Milestone I/II review in July 1997, the MDA (the Defense Acquisition Executive) decided to conduct a forty month Program Definition and Risk Reduction Phase rather than entering immediately into the EMD phase. Service-level budget concerns were the basis of the delay; there just were not sufficient funds to enter EMD. Since the original risk assessment was based on the level of technology maturity, and the technical approach remained unaltered, the assessment appeared to remain valid.

The Chief of Engineering, as the program's principal risk manager, provided the following history of the program's risk management efforts to you and the PM.

RISK MANAGEMENT PLANNING

Experts were assembled from the program office, government test agencies, user community, and government laboratories, based on their expertise in the following discipline areas:

Hardware: Launcher, Missile, Communications, and Fire Control

Propulsion: Considered independently- the engine is on a separate, FFP contract

Software: Use of Ada and C++

Program Cost Estimating: Analogous and Engineering

Support: Logistics and Training

Producibility: Parts count

There was no contractor participation since the contractor had not yet been selected when the risk assessment was conducted. However, results from various contractor risk assessments of the ATDs generated during the POP/CE phase were incorporated in the risk assessment produced by the Program-level PRMIPT.

Risk was defined in terms of technology maturity, as follows:

- ***High Risk*:** Desired level of performance has never been achieved before using this type of technology.
- ***Moderate Risk*:** Desired level of performance has been achieved using this type of technology, but not in this type of system, or only in a technology demonstration.
- ***Low Risk*:** Desired level of performance has been achieved using this technology in this type of a system.

The acquisition strategy, which included cost, schedule, and performance goals associated with the technical approach, was not revised. It had been developed by top program management with feedback from the ATD contractors. The objective of the risk assessment and risk management plan was to identify risks and to develop a system to manage those risks, all within the framework of the current strategy.

RISK ASSESSMENT

Risk Identification

Each expert was asked to identify risk events within their functional area based on the maturity of the technology involved and the sufficiency of the cost and schedule allocations. Each risk event was described in terms of the performance objective to be achieved and the technical problems which might lead to an inability to reach that performance objective.

Program-level cost risk was assessed separately. Major program level risks to achieving cost objectives, such as sub-contractor management and the adequacy of the Earned Value Management System (EVMS), were identified by the cost-risk assessment team. The average of these risks was used to determine the program cost risk.

The missile engine had no cost risks due to the separate fully funded, FFP manufacturing contract.

Risk Analysis

Individual and separate cost risks were valued on a scale of 1 (low risk) through 5 (high risk). All evaluation team members were asked to use the standard definition of risk described above.

Risk Integration

Individual risk events were gleaned from WBS elements. An average risk was determined for each risk event (with technical and cost impacts) as follows. Each individual risk event was given a risk score value and a weighted number was applied to that risk event – the latter weighting represented the importance of that individual event. For example, two equally important individual risk events with technical impact would each receive a weighting of 50% or 0.5. The total risk "technical" was determined by multiplying the risk score value by the weight for each risk event, and then adding the resulting products; the average value was then determined by dividing by the total events in the "technical" block of events, per the following example:

6.3.2.2 RISK MATRIX – WBS Element: Engine; Sub-element: Engine Suppressor

Risk Events	Value	Weight	Products	Average
TECHNICAL PERFORMANCE				
• Engine Suppressor Performance	2	0.4	0.8	
• Body Contrast Temperature	3	0.4	1.2	
• Material Development	2	0.2	0.4	
			2.4 / 3	**= 0.80**
COST				
• Development	2	0.2	0.4	
• Fly Away	2	0.4	0.8	
• O&S	2	0.4	0.8	
			2.0 / 3	**= 0.67**

If there were only one risk event, the risk weight would be 100%. If a new risk event was identified within a WBS element, the risk weights would be re-evaluated to make room for the weight of the new event.

Risk events were ranked within each WBS area; e.g. within the "Engine" major area the suppressor was compared with the engine block. Risk events were not compared across major WBS areas – engine, airframe, guidance, etc., due to the differences in valuations between the different IPT assessment teams. A cut-off line was established within each WBS major area to identify top risk events. (see Risk Handling below)

RISK HANDLING

Handling Option Identification

The acquisition strategy was firm. Therefore, neither the program's PRMIPT nor individual WBS IPTs were allowed to make cost, schedule, and performance trade-offs in response to identified risk events. The principal handling options considered were:

- Assignment of responsibility for risk management to specific WBS elements/IPTs. Each element IPT manager was expected to have a risk management plan for their WBS element.

- Creation of a risk assessment system whereby successful completion of identified program activities resulted in a reduction in assessed risk. The PRMIPT identified those activities which related to WBS element risks, and determined the amount by which risk assessments would be reduced based upon successful completion of the event.

- Creation of a tailored EVM system. Cost/Schedule/Performance information related to a risk element was provided to the program's risk manager (PRMIPT chair) with contractor analysis for identified variations from plan.

Handling Option Analysis

The risk handling options had no significant cost, schedule, or performance trade-offs. There was no evaluation of costs relative to benefits. All options were applied to all risks.

Handling Option Integration

Since risks in one major WBS area were not compared with risks in another major WBS area, e.g., engine vs airframe, it was not necessary to identify cross-element effects of risk handling options.

RISK MONITORING AND REPORTING

A Risk Management Board, chaired by the deputy program manager and with representatives from the program and contractor program offices, was created with the responsibility for regular review of those risk events above the PM's cut off line. The risk management board presented regular verbal reports to the program manager and Program Executive Officer (PEO) showing the program's progress in reducing the top risks based on successful completion of program events. The PRMIPT made inputs to the Risk Management Board.

INTEGRATED PRODUCT TEAM (IPT) – TASKING

(Worked by Individual Work Groups)

Identify pluses and minuses with the program's current risk management process and recommend improvements. Use the following questions to assist with your task:

Risk Management Planning

Is there an organized program risk management process? Are IPTs organized and trained to perform risk management? Do IPT members understand their individual responsibilities? Is there contractor participation? Did the Program Manager adequately prepare for risk management? What is purpose of the PRMIPT?

Risk Assessment

Risk Event Identification – Was a structure (such as a WBS) in place to identify risk events? What would be an effective structure? Were sources of risk identified?

Risk Analysis **--** Were risk events identified in terms of probability and impact? Were consequences/impacts of risk events identified in terms of cost, schedule, and performance? How can the process be improved?

Risk Integration **--** Does the process for integrating at each of the program-level WBS elements make sense? Were risks effectively compared across the program?

Risk Handling

Risk Handling Option Identification – What are the range of risk handling options and were they used in this case? How would research and analysis support risk handling?

Risk Handling Option Analysis **--** Did the program office evaluate risk handling options relative to their cost, benefit (in terms of risk reduction), and feasibility? Did they choose those that would result in the best balance between cost, schedule, performance, and risk? Did the program office identify risk that would still remain after application of the best risk handling options? I.E., did the risk handling options handle/mitigate program risk? How could the process be improved?

Risk Handling Option Integration **--** Did the program office integrate risk-handling options to develop the set of those best for the program? Did they determine the remaining risk at the program level after assessing risk at the lower WBS levels? How could this process be improved? Has the risk assessment been implemented in a revised acquisition strategy? Were real risk identification, handling, and monitoring processes and activities included in the finalized risk management plan?

Risk Monitoring/Reporting

Is a management information system in place to monitor, track, and report on risk management activity? Is the monitoring/reporting process tied to key program and risk management decisions? If not, what else could they have done? How could the process have been improved?

Risk Management Tools

The following is a list of risk management tools available for acquisition managers.

The promulgation of this list does not specifically endorse or imply endorsement of any products contained any of the products.

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RiskTRAK rank-orders and tracks project-defined risk events as a function of their estimated cost, schedule, and technical performance impacts. This includes quantifying the effects of coupled (dependent) risk events. The process begins with the formation of a cross-functional project risk assessment team. They then accomplish 6 steps of the RiskTRAK process: identify key program risk areas, define the set of risk events that fall within the risk areas identify key program risk areas, define the set of risk events that fall within the risk areas identified (this includes defining event coupling relationships), assess subjective probabilities that each risk event will occur, estimate cost, schedule, technical (CST) impacts for each risk event, compute and display the prioritization of risk events by RiskTRAK, and evaluate results, checking for consistency, and conduct sensitivity analyses. The results of this process serves as inputs to the formulation of risk mitigation strategies by the management team.

RiskTRAK is evolving as a PC database application and is available by contacting the POC. Among the displays of RiskTRAK results are the primary display of the relative ranking of risk events prioritized by their CST impacts and additional displays that show the level of coupling between any two risk events.

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A STRUCTURE FOR IDENTIFYING AND PRIORITIZING PROGRAM RISKS.

Prepared for: U.S.A.F.

Prepared by: Department of the Air Force, Headquarters ESC (AFMC),

Hanscom AFB, MA, 01731-5000

POC: P. R. Garvey, MITRE, (617) 271-6002

Risk Matrix was developed by the Electronic Systems Center (ESC) to provide a structure for identifying and prioritizing program risks. Risk Matrix facilitates the thought process of identifying risks and provides a structured way to prioritize, evaluate, document, and manage the impact of key risks on projects.

Once important risk areas (like technology not available in time to meet requirements or requirements not well defined) are identified, Risk Matrix can facilitate how to allocate resources to manage or mitigate them (like select alternative technologies or create prototypes).

The Risk Matrix is used by a risk management Integrated Product Team (IPT) in a workshop environment involving individuals who are familiar with the program and relevant technologies. The participants work together to identify, assess, and prioritize critical program risks. The IPT should include the sponsoring organization, operational experts, program management, technical experts (including persons from logistics and program control), and contractors. This process should also involve the users, especially the developers of the Operational Requirements Document (ORD) and Concept of Operations (CONOPS).

The process involves identifying the requirements, identifying the risk associated with each requirement, accessing their impact on the program, estimating a probability for the risk to occur, and ranking the impact and probability of occurrence. After you identify and rank risks, determine the best manage/mitigate approaches, considering costs, schedule, and staffing resources.

Risk Matrix should be used from the beginning and continuously throughout a program's life cycle.

During the product development phase, the Risk Matrix is jointly maintained by the contractor and Government to access and manage the risks, including those associated with updates or program changes before they are initiated.

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POC: P. R. Garvey, (617) 271-6002. The MITRE Corporation, Economics and Analysis Center, 202 Burlington Road, Bedford, Ma. 01730

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Software development effort estimates have several major sources of uncertainty. Among these uncertainties are the size of the project, the development attribute ratings, and the error of the estimation model. This paper presents three methods which quantify the effects of these uncertainties on development effort estimates. One method takes advantage of the inevitability of the nonlinear effort models to approximate the effort probability distribution. In the case of a single software configuration item, this method yields the exact probability distribution. A second method uses Taylor series to estimate mean and variance of effort, and then specifies its probability distribution by invoking the Central Limit Theorem. The third method, specific to the Construction Cost Model (COCOMO), invokes a Monte Carlo simulation technique to approximate the effort probability distribution. The result of case studies based on the COCOMO models are presented and compared. The mathematical details are provided so that analysts may easily review and implement these methods within their organizations. Methodology described can be programmed in an Excel spreadsheet.

BIVARIATE COST-SCHEDULE PROBABILITY MODELS

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Prepared by: Chien Ching Cho, Leah M. Gaffney, The Journal of Cost Analysis, Fall 1996

POC: Chien Ching Cho, Leah M. Gaffney, (617) 271-6287

A frequently used methodology in cost estimating is the use of linear cost estimating relationships between prime mission product (PMP) and non-PMP costs such as test and program management. When assessing the uncertainty associated with such an estimate, it is often improperly assumed that the cost components are either totally independent or perfectly correlated. These simplifying assumptions could lead to a large error in the construction of the total cost distribution, thus significantly impacting the ensuing risk assessment. This paper presents a systematic approach for constructing a total cost equation using the stage-wise regression procedure. This equation will consist of only independent components and is thus convenient for generating the total cost distribution. While using only standard regression outputs in the calculation, the approach implicitly captures all the correlation among cost elements. An application of the approach to an illustrative program cost estimate is also included. Methodology described can be programmed in an Excel spreadsheet.

C-RISK - COST RISK

PRODUCES AND JUSTIFIES COST - PROBABILITY DISTRIBUTIONS OF WBS ELEMENTS AND CORRELATION BETWEEN THEIR RISK-RELATED BOUNDS.

Prepared for: The Air Force Space and Missile Center (AFMC/SMC) and the Aerospace Corporation. Version 3.0, 1994

Prepared by: The Aerospace Corporation. Mail Station MM4-021, PO Box 92957 Los Angeles, CA 9009-2957

POC: Stephen A. Book, (310) 336-8655

C-RISK was originally developed for in-house use by the Air Force Space and Missile Systems Center (AFMC/SMC) and the Aerospace Corporation. It is now available upon request to all U.S. Government Agencies and their contractors. Its objective is to produce and justify cost-probability distributions of individual work-breakdown-structure (WBS) elements and correlation between their risk-related bounds. The resulting distributions and correlation can then be input into FRISK, Crystal Ball, @Risk, or other commercially available software to compute the probability distribution of total cost.

C-RISK models work-breakdown-structure (WBS) element costs as the sum of a best estimate, a Gaussian mean-zero error component, and risk component assumed to have a right-triangle distribution with peak at 0 and right-end as determined by a "cost-growth sensitivity factor" that reflects the impact of requirements for new technology upon probable cost growth. Inputs to the C-RISK computer program include each WBS element's best estimate of cost, its standard error of the estimate (e.g., if estimated using a statistically derived cost-estimating relationship or "CER") and an estimate of the percentage of technology that is new. The primary ground rule of C-RISK is that the WBS elements are organized into "associate groups" such that the new-technology-based right-triangle components of WBS elements have pairwise correlation 1.00 within an associate group and zero with WBS elements in a different associate group. C-RISK mathematics then calculates the defining parameters of the cost probability distributions and the correlation between pairs of such distributions. These parameters and correlation can then be input into risk-analysis software for computation of the total cost probability distribution.

TRL-RISK-TECHNOLOGY-READINESS-LEVEL-BASED RISK ANALYSIS

A COST-RISK ANALYSIS PROCEDURE

Prepared for: NASA, Version 1.0, February 1996

Prepared by: The Aerospace Corp. Hallmark Building 13873 Park Center Road Herdon, VA 22071

POC: Erik L. Burgess, (703) 318-2477

TRL-RISK is a cost-risk analysis procedure for using NASA's "Technology Readiness Level" (TRL) as a useful metric for expressing technology/design maturity. The TRL serves as a quantitative input into the cost-risk analysis process. It has been implemented as part of the Small-Satellite Cost-Engineering Model (SSCEM) under development for NASA's Jet Propulsion Laboratory (JPL).

TRL-RISK's ground rules are the following:

(1) cost-estimating errors are random with zero mean, standard deviation associated with the estimating method, and uncorrelated among work-breakdown-structure (WBS) elements

(2) cost impacts of technical risks are random with a right-triangle distribution, in which the maximum possible cost is related to TRL status, and cost growth patterns of different WBS elements are uncorrelated. SSCEM is implemented in a Microsoft Excel Spreadsheet.

METHODS AND METRICS FOR PRODUCT SUCCESS

A GUIDE TO TECHNICAL METHODS AND METRICS WHICH HAVE PROVEN SUCCESSFUL IN PRODUCT DEVELOPMENT.

Produced for: Assistant Secretary of the Navy (Research, Development and Acquisition)
Produced by: Wills J. Willougby Jr., Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) 2000 Navy Pentagon, Washington D.C. 20350
POC: D. Porter (703) 602-5506

Produced in July 1994, the book is an attempt to guide government and industry toward an understanding of those technical methods and metrics which have been proved over time to ensure an successful product. The focus is in the technical process that will supplant mil-specs as the basis for military acquisition. Use of proven best practices and the management of the technical process comprising design, test, and production discipline are combined in the belief that management of these process will reduce many other types of risk. Two main sections make up the book, Methods and Metrics.

Methods provides the steps recommenced for managing the technical process. Templates, Combined Government/Industry Acquisition Flowchart and the Program Managers WorkStation (PMWS) are provided in the book as means of process identification. Step 1 is to identify which critical processes apply to the current program phase. Step 2 is to determine the industry best practices for those critical processes and program-specific practices for those critical processes. Step 3 is to measure the variance between best practices and the program and classify the level of risk. Step 4 is to determine appropriate technical and management corrective actions. Step 5 is to generate the technical risk assessment report. Metrics provides a series of quick look metrics for principal risk areas in design, test and production and gives specific guidance for assessing technical processes. The metrics also reference documents and other sources which should be reviewed when conducting an assessment. Questions are included in the metric as a guide to what a program manager must ask in order to evaluate the level of technical risk in any program. Each of the tables identities principal risk areas, measures of effectiveness and the program data sources.

The appendices contain a technical risk report example and a “watch out for” list which have historically been associated with heightened potential for risk.

There is potential to include this book in the PMWS or as a part of the BMPnet to ensure widest dissemination.

COST-RISK IDENTIFICATION AND MANAGEMENT SYSTEM (CRIMS)

PROVIDES A MEANS TO IDENTIFY THE COST IMPACTS ON PROGRAM DUE TO RISK.

Prepared for: The Air Force Material Command Space and Missile Systems Center.
Prepared by: Space and Missile Systems Center, Financial Management and Comptroller
2430 E. El Segundo Blvd. Suite 2010, El Segundo, Ca, 90245-4687
POC: D. R. Graham (SMC/FMC) and J. Dechoretz (MCR) (310) 363-0131

CRIMS was developed as a means to identify the cost impacts on a program due to risk. Its use enables analysts to quantify the impact of technical and schedule uncertainty, positively differentiate between the different drivers of acquisition cost change, and to track risk driven cost change to better predict future outcomes. The process consists of three steps or components. The first is the Relative Risk Weighting (RRW) technique where cost risk is identified using the Analytical Hierarchy Process cost-risk range development method and Monte Carlo summarization of Work Breakdown Schedule (WBS) element cost-risk distributions. Second, using the Risk a Management Feedback system (RFMS is to track the realization of that risk and its cost impacts over time using tested and trusted earned value management methods to assist the program managers and finally, compile the result in a cost-risk database (CRDB) to compare actual to initial expectation and lessons learned for the nest application.

The CRIMS process may be applied throughout the acquisition phases of a program. The RRW technique may be used as a stand alone process to determine the adequacy of a program budget or credibility of a contractor estimate. A desired result of using the CRIMS is that program managers will become risk managers vice risk avoiders in line with the acquisition steamlining initiatives. The typical representation of CRIMS results in S curves for the various phases of acquisition where the x axis is cost-risk effects of risk mitigation and the y axis is confidence level.

FRISK - FORMAL RISK ASSESSMENT OF SYSTEMS COST ESTIMATES

PROVIDES A MEANS FOR QUICK RESPONSE TRADE STUDIES.

Prepared for: Air Force Space and Missile Center (AFMC/SMC)

Prepared by: The Aerospace Corporation., PO Box 92957 Los Angeles, CA 9009-2957, Version 3.2, Sep 1992

POC: Stephen A. Book, (310) 336-8655

Cost estimates are typically derived by determining low, best estimate, and high cost for each of several cost elements in a Work Breakdown Structure (WBS) as a result of technical risk assessment after which a statistical distribution, such as a triangular, is postulated for each element cost. Means, variances, and typical percentiles can be derived from the statistical distribution. Dependencies among cost elements can be quantified in terms of a correlation matrix. Then the distribution of the sum of the element cost is determined, typically by a Monte Carlo sampling technique.

The FRISK model is an analytical rather than Monte Carlo based cost-risk model thus it provides a means for quick response trade studies. FRISK evaluates the total cost-distribution of a system design, given its WBS. Thus FRISK provides a simple (entirely analytical) tool to provide estimates of typically desired percentiles of system cost of a proposed system design, in addition to the best-estimate cost. Assumptions underlying Frisk structure are that cost variation of each element of a WBS is expressed in term of the lognormal distribution.

FRISK is an easy to use and robust technique for evaluating system design cost-risk, asking the user to characterize the system design in a straight forward manner. It also can be used to do cost-risk comparisons of multiple system designs, assuming that the total cost distribution for each design can be adequately characterized by the lognormal distribution.

Since the mathematical structure of FRISK is simple, it is amenable to be programmed on a personal computer. The software is available to U.S. Government Agencies and their contractors.

CRYSTAL BALL 4.0

A MANAGEMENT TOOL FOR FORECASTING AND RISK ANALYSIS

Prepared for: Commercial sale

Prepared by: Decisioneering, Inc. 1515 Arapahoe Street, Suite 1311, Denver, Colorado, USA 80202

POC: Decisioneering, Inc. Telephone: (303) 534-1515, Facimile: (303) 534-4818, and Internet: www.decisioneering.com

Crystal Ball is a risk analysis tool that uses Monte Carlo simulation to forecast potential outcomes for a program when uncertainty exists for multiple elements of the program. Crystal Ball acts as a spreadsheet add-in that requires either Microsoft Excel 4.0 (or later) or Lotus 1-2-3 Release 4 (or later). Data are entered as a spreadsheet(s) and then analyzed by the add-in module.

With Crystal Ball, the user identifies the various program risk-elements which might impact program performance as well as the relationship between each risk-element and the overall program performance. For each risk-element, a “best-estimate” outcome, a range of possible outcomes, and an expected distribution of outcomes are also provided by the user. A library of common distributions is available, or custom distributions can be generated from historical data or other user estimates. The software takes these risk-element-level estimates and uses Monte Carlo techniques to model the range and distribution of possible outcomes for the program as a whole. Sensitivity and other “what-if” analyses can be rapidly performed by simply modifying the risk-element estimates. Technical performance, cost, and schedule risk can all be evaluated within the Crystal Ball methodology.

In addition to forecasting, Crystal Ball contains a variety of statistical analysis tools which can be used to evaluate trends and uncertainties associated with different basic forecasts. The software also includes automatic graphing tools for easy data presentation and report generation.

OPEN PLAN PROFESSIONAL™, OPEN PLAN DESKTOP™, AND OPERA

MANAGEMENT TOOLS FOR PROJECT MANAGEMENT

Prepared by: Welcom Software Technology: WST Corporation, 15995 North Barkers Landing, Suite 275, Houston, Texas 77079-2494
POC: Diana M. Melton, (713) 558-0514; e-mail dmelton@wst.com

The Welcom Program Management software package includes Open Plan Professional, a program that uses embedded tools to integrate project management functions across an organization, Open Plan Desktop, which may be used to schedule projects, manage resource requirements, perform “what if” analyses, report earned value, and use corporate wide databases, and Opera, an Open Plan extension for risk analysis.

Open Plan Professional is designed for high level users such as project planners and schedulers. It includes the tools for schedule and resources planning, earned value reporting, and roll-up features for high level review and analyses. It provides a set of standard reports of project data, but also allows flexible reporting and customization.

Open Plan Desktop is designed for top-down planning by management and for development of projects by team members. The “roll-ups” of project information for high level views of planning and status may be done by Open Plan Professional users. Both program share a common data structure.

Opera provides tools for analyzing the consequences of uncertainty in a program. Users may choose one of four probability distributions, normal, uniform, triangular and beta for each activity in the program structure and then Opera performs a Monte Carlo simulation to estimate the effects of probability distributions on project dates and costs. The data are stored in a database for further analyses and report generation.

Opera provides standard reports, such as activity checklists, probability distribution for total project cost, bar charts based on expected values of dates, and uses Open Plan’s flexible report writing capability.

IPD TOOLKIT

A COLLECTION OF PROCESSES AND SOFTWARE TOOLS THAT PROVIDE INTEGRATED COST, SCHEDULE AND RISK PERFORMANCE MEASUREMENT

Prepared for: Commercial sale

Prepared by: C/S Solutions, Inc. 1324-J State Street # 174, Santa Barbara CA, 93101-1024

POC: C/S Solutions, Inc. Telephone: (805) 653-4951 Facsimile: (805) 563-4961 Internet: www.cs-solutions.com

The IPD tool kit is designed as an aid for the Integrated Product Development Team (IPD) Members. It integrates and customizes off-the-shelf software including MS Project, MS mail, wInsight, C/S glue and Risk +. The IPD tool kit currently supports Windows 3.1, 95. NT and Macintosh.

The tool kit provides exception reporting via color codes to identify contract elements with poor performance and arrows to indicate the trend since the previous month. This allows quick identification of problem areas. The tool kit also displays trend charts, report and true schedule status. The re-integration of cost and schedule data allows members to review planned and accomplished work and cost with an analysis view.

Risk+ uses sophisticated Monte Carlo-based simulation techniques to provide members with quantitative assessments of cost and schedule risk. wInsight integrates earned value into the management process. It provides the members with a means of proactive performance management process. It provides the member with a means of proactive performance management by integrating cost performance data with true schedule status. C/S glue is the optional interface to MS Project.

Members are able to quickly produce a variety of reports and briefings using the tool kit. They are also automatically informed by E-Mail when performance metrics have breached predetermined cost and schedule management thresholds.

CONSOLIDATED RISK ASSESSMENT METHODOLOGY

Overview: Consolidation Risk Assessment Methodology (CORAM 3.2)
CORAM is a user-friendly risk assessment application comprised of training, documentation and software. Four software modules are available: 1) schedule, 2) cost and technical risk assessment, 3) source selection evaluation forms, and 4) briefing charts' generation module.

Description:

CORAM supports acquisition strategy planning and budgets as well as the source selection process and post contract award tracking. CORAM can also be used for cost proposals and is intimately tied to the Integrated Master Plan (IMP) and the Integrated Master Schedule (IMS) information. All tasks, items and events of the IMP and IMS can be assessed with regard to risk; e.g., technical, schedule and cost, using CORAM.

Evaluation forms and other reports and requests such as Clarification Requests (CRs), Deficiency Reports (DRs), Points for Negotiations (PFNs) and Discussion Questions (DQs) etc., used in the source selection process are generated by one of the CORAM modules. Briefing charts, Proposal Evaluation Reports (PERs) and Performance Assessment Reports (PARs) are also generated.

The CORAM risk assessment methodology and the resultant success in mitigating identified risks, combine to provide discipline and consistency in the cost and schedule ratings for Contractor Performance Assessment Reports (CPARS).

Current Version: 3.2 (released July '96)
Upgrade planned for: Oct '96

DoD Functional Classifications Supported:

Program Management

Service/Command Unique Features:

DoD-wide usage

Assessment of Tool:

PROS: CORAM is an excellent tool for risk management. It effectively gets contractors and Government on same wavelength. CORAM provides quantitative evaluation of costs associated with potential risk areas. It can be used on widely different approaches and cost bases, and decreases the time and cost associated with source selection.

CONS: CORAM requires top level commitment from government and contractors. It necessarily increases up-front planning and scheduling activity in order to reduce later requirements.

Other Users:

Wright Patterson AFB - AFASC (513) 255-6101 Gayle Ingraham
Warner Robins AFB - AFASC (912) 926-1686 John Driver
Army MICOM JTUAV Office
Navy - NAVAIR PMA-159

Training Requirements: Some training recommended.
Hardware Requirements:
Processor: PC 80486
Ram: 16 MB RAM
Disk: 120 MB
Optimum: Pentium with 32 MB RAM
Software Requirements/Specifications:
Operating Systems Supported: Windows 3.1 (PC) , Windows 95 (PC), Windows NT (PC)
Databases Supported: Access
Development Environment: Visual Basic
COTS Packages Required: Microsoft Office, Project 4.0 and Excel 5.0
Single-User (Stand-Alone)
Multi-User (Networked)
Development Status:
Fully Operational
Undergoing Upgrade Price: The tool is Government owned. There is no cost to Government organizations/agencies or Government contractors at this time.
Obtaining the Tool: Contract vehicles under which the tool is available: Air Force Technical, Engineering and Acquisition Support (TEAS) Systems Engineering and Technical Assistance (SETA) contract at Eglin Air Force Base.
Contact Mr. Gregory K. Jenkins at address listed below.
Point of Contact: Mr. Gregory K. Jenkins
Phone Number(s): DSN: 872-2746 (V) 872-1470 (F)
Commercial: (904) 882-2746
FAX: (904) 882-1470
E-Mail: jenkinsg@eglin.af.mil
Organization: Air Force Aeronautical Systems Center
Command: Air Force Air Material Command, Armament Product Group Manager
Address: 207 West D. Avenue, Suite 308

PERFORMANCE ANALYZER for Windows

PA Win is the Government and Commercial standard for the reporting and analysis of contract performance data, including the Contract Performance Report (CPR), Cost/Schedule Status Report (C/SSR) and Contract Funds Status Report (CFSR). PA Win exports and will import a delimited flat file containing all data required for compliance with the DoD EDI 839 Implementation Convention. It also displays contract performance trends, and calculates Estimates at Completion (EAC).

Description:

PA, originally developed by the USAF as a tool for monitoring contractor performance, has evolved to PA Win and migrated to cross-service use. The addition of various charts, reports, and formulas, based on customers' needs, fostered this evolution.

The management charts, within the PA Win application, include Army Contract Performance Charts and Army Cost/Schedule Variance Trends. The indicators displayed on these charts provide a comprehensive summary of the overall contract status and trends. The "generic" variance charts and performance charts include fewer indicators than those on the Army charts, but are easily adaptable to any organization's acquisition management operations, depending on the information required by the user.

Formulas to calculate Estimates At Completion (EAC) include standard formulas as well as EAC formulas specifically developed for, and used by, the US Navy's Naval Air Systems Command (NAVSEA) and the US Army's Missile Command (MICOM).

The Resource Management Review (RMR) report was originally developed for the Ballistic Missile Center at Edwards Air Force Base, CA, to report contract status to the program manager. This report provides a narrative overview of contractor performance.

PA for Windows accepts data from PA Version 3.2 for DOS and PA Version 4.0/4.1 for DOS. Data can be loaded electronically via the PA transfer file, the American National Standards Institute (ANSI) EDI 839 standard for the transmission of contract performance data, or from prior PA versions through the Backup /Restore functions.

PA Win currently:

— allows contracts to be combined into programs for more high-level analysis;
— supports reporting of elements in both dollars and man-hours;
— provides full multi-user capability;
— provides the ability to transfer CFSR data using the EDI import and export features;
— exports data to over 15 different formats;
— allows users to change the attributes (chart type, colors, fonts, gridlines, scale, point markers,

etc.) of any of the 20 charts; and

— enables users to sort either programs, contracts, or Work Breakdown Structure (WBS)/Organizational Breakdown Structure (OBS)/Integrated Product Team (IPT) elements in any of 15 sort options.

PA Win 1.2 upgrade to PA Win 1.3 will include:

— customized chart save feature;

— increased recalculation speed;

— more rapid access to analysis menu;

— improved manual data entry for monthly input screens;

— support for both the new and the old Data Item Description (DID) for CPR, C/SSR, and CFSR reports, to include the electronic transfer of this data;

— modification to the EDI import and export to exchange city, state, zip code, and Data Universal Numbering System (DUNS) number, adjusted current values, and CFSR remarks information; and

— enhancements to the PA Transfer file to handle the transfer of adjusted current values.

Current Version: 1.2 (released Jan '96)

Upgrade planned for: To be determined

PRO: PA Win provides top level and individual level Work Breakdown Structure (WBS) highlights on cost and schedule variances. It calculates a range of potential estimates to complete based on current and cumulative indicators. These estimates are then used in Defense Acquisition Executive Review Summaries (DAES) and Selected Acquisition Reports (SAR).

The capability exists for Program Directors or Program Executive Officers (PEOs) to evaluate several contracts concurrently for risk management.

The ability to identify dollars or hours by WBS element allows Integrated Product Team (IPT) leaders to track staff hours to milestone schedules.

CON: The user of this model must have intermediate level knowledge in the discipline of Cost Performance Management.

As with any sophisticated system, PA Win model reliability increases with user experience.

Initial installation of current software versions must be done precisely according to directions in order to flow previous data through from prior DOS versions of PA. It is highly recommended that the PA Win Hotline be consulted during installation.

Other Users:

PA/PA Win has approximately 2,000 Government and Commercial users in the United States, Canada, Australia, Sweden and France. In the United States, the Government user-community consists of the Army, Navy, Air Force, Defense Logistics Agency (DLA), the Ballistic Missile Defense Organization (BMDO), Federal Aviation Administration (FAA), Federal Bureau of Investigations (FBI), the Coast Guard, the Department of Energy (DoE) , the Internal Revenue Service (IRS), the National Security Agency (NSA) and National Aeronautics and Space Administration

(NASA). The Commercial user-community includes such companies as Lockheed Martin, McDonnell Douglas, Raytheon, Boeing, Texas Instruments, United Defense LP, and TRW.

Training Requirements: No formal training is required; however, 1.5 day courses, for the use of CPR, C/SSR and CFSR data with PA Win, are provided by Cost Management Systems, Inc., (703) 938-7292. Training is provided at the user's site or at the company site.

Hardware Requirements:

Processor: PC 80386

Ram: 4 MB RAM

Disk: 10 MB

Optimum: PC 90486 with 8 MB RAM or higher

Operating Systems Supported: Windows 3.1 (PC), Windows 95 (PC), Windows NT (PC)

Databases Supported: FoxPro

Development Environment: XVT Development Solution for C++

COTS Packages Required: Data is stored in MS FoxPro-compatible tables. Reports can be exported to Lotus 1-2-3, Quattro Pro, MS Excel, WordPerfect, MS Word, Rich Text Format (RTF) or a variety of American Standard Code for Information Interchange (ASCII) text files. Software support is provided 8 am through 5 pm Eastern, Monday through Friday, at (703) 938-7292.

Development Status: Fully Operational; Undergoing Upgrade

Price: The tool is Government owned.

There is no cost to Government organizations/agencies or Government contractors at this time.

Obtaining the Tool:

PA Win is available for download from the SAF/AQ Home Page. The URL is: http://www.safaq.hq.af.mil/safaq. For more information, contact the individual(s)/agency(s) listed below.

Point of Contact: Kathleen Jones

Phone Number(s): DSN: 225-3590

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